

Video Terms and Acronyms

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Fade – A video editing term that describes switching from one video source to a black level or from black to a video signal. This is commonly called a “fade to black” or “fade from black.”

Fade to Black – The picture luminance is reduced until the screen is black.

Fader – Console control which allows an operator to perform manual dissolves, fades, and wipes.

Fader Bar – A vertical slide controller on audio and video equipment.

Falling Edge – High-to-low logic or analog transition.

Fan-In – Electrical load presented by an input. Usually expressed as the number of equivalent standard input loads.

Fan-Out – Electrical load that an output can drive. Usually expressed as the number of inputs that can be driven.

Faroudja – Yves Faroudja and Faroudja Laboratories. First to market an advanced NTSC encoder with pre-combing; proponent of the Super-NTSC ATV system and of a 1050 scanning line (900 active line), progressive scan, 29.97 frame per second, 1.61:1 aspect ratio HDEP system.

FAS – Frame Alignment Signal.

Fast Forward – The provision on a tape recorder permitting tape to be run rapidly through it in normal play direction, usually for search purposes.

Fast Forward Playback – The process of displaying a sequence, or parts of a sequence, of pictures in display-order faster than real-time.

Fast Reverse Playback – The process of displaying the picture sequence in the reverse of display order faster than real-time.

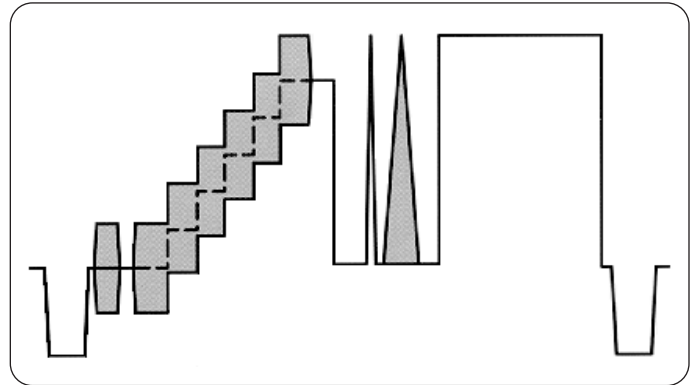
Fast-Page Mode – A read or write mode of DRAMs characterized by a decrease in cycle time of about 2-3 times and a corresponding increase in performance. The data accessed in Fast-Page Mode cycles must be adjacent in memory. See EDO.

FC-AL (Fiber Channel-Arbitrated Loop) – Architecture used to maintain high data transfer rates over long distances. With FC-AL storage arrays can be separated by as much as 20 kilometers, connected by only one non-amplified Fibre Channel fiber optic link. In the dual-loop architecture, data transfer rates can reach 200 Mb/s. Another advantage is increased fault tolerance. In the unlikely event of a drive failure, port bypass circuits single out each failed drive and quickly route around it, with no limitation on the number of drives that can be bypassed.

FCC (Federal Communications Commission) – **a)** The government agency responsible for (among other things) the regulation of the electromagnetic spectrum utilization in the United States, and the body that licenses radio and television broadcast stations. The FCC is an independent government agency, which answers directly to Congress. **b)** The FCC rules and regulations constitute mandatory standards for broadcasters, CATV operators, transmission organizations, and others. See also ACATS.

FCC 73.699 – Federal Communications Commission (FCC) NTSC video signal specifications standard.

FCC Composite Test Signal –



F-Connector – A video connector characterized by a single metal wire. F-connectors may be either push-on or screw-post.

FDDI (Fiber Distributed Data Interface) – Standards for a 100 Mbps local area network, based upon fiber optic or wired media configured as dual counter rotating token rings. This configuration provides a high level of fault tolerance by creating multiple connection paths between nodes. Connections can be established even if a ring is broken.

FDM – Frequency Division Multiplex.

Feature Connector – An expansion connector on the VGA that can accept or drive video signals to or from the VGA. This is used in applications involving video overlay. This is also called VESA Pass-Through Connector.

FEC (Forward Error Correction) – **a)** System in which redundancy is added to the message so that errors can be corrected dynamically at the receiver. **b)** Error control bits added to useful data in the QAM/QPSK modulator.

Feed – The transmission of a video signal from point to point.

Feed Reel – Also called “stock,” “supply,” or “storage” reel. The reel on a tape recorder from which tape unwinds as the machine records or plays.

Feedback – **a)** Information from one or more outputs to be used as inputs in a control loop. **b)** A loop caused by audio or video signal being fed back into itself. In video the effect is caused when a camera is directed at its receiving monitor. In audio the effect, manifested as an echo or squeal, is caused when a microphone is aimed at a speaker.

Female Connector – A connector that has indentations or holes into which you plug a male connector. An example of a female connector is an electrical wall outlet that accepts an electrical plug.

Ferrichrome – A relatively recent word describing the technique of dual coating with both a layer of gamma ferric oxide and a layer of chromium dioxide. An intermediate level bias position used only for ferrichrome tapes.

Fetch – Reading an instruction from memory.

FF – See Full Field.

FFT (Fast Fourier Transform) – A mathematical means of converting time-domain information to frequency-domain information.

Fiber Bundle – A group of parallel optical fibers contained within a common jacket. A bundle may contain from just a few to several hundred fibers.

Fiber Channel – See Fibre Channel.

Fiber Optics – See Optical Fiber.

Fiber-Optic Cable – “Wires” made of glass fiber used to transmit video, audio, voice, or data providing vastly wider bandwidth than standard coaxial cable.

Fibre Channel – A high-speed data link planned to run up to 2 Gbps on a fiber optic cable. A number of manufacturers are developing products to use the Fiber Channel-Arbitrated Loop (FC-AL) serial storage interface at 1 Gbps so that storage devices such as hard disks can be connected. Supports signaling rates from 132.8 Mbps to 1,062.5 Mbps, over a mixture of physical media including optical fiber, video coax, miniature coax, and shielded twisted pair wiring. The standard supports data transmission and framing protocols for the most popular channel and network standards including SCSI, HIPPI, Ethernet, Internet Protocol, and ATM.

Field – **a)** In interlaced scan systems, the information for one picture is divided up into two fields. Each field contains one-half of the lines required to produce the entire picture. Adjacent lines in the picture are in alternate fields. **b)** Half of the horizontal lines (262.5 in NTSC and 312.5 in PAL) needed to create a complete picture. **c)** One complete vertical scan of an image. In a progressive scanning system, all of the scanning lines comprising a frame also comprise a field. **d)** An area in a window in which you can type text. **e)** A television picture is produced by scanning the TV screen with an electron beam. One complete scan of the screen is called a field. Two fields are required to make a complete picture, which is called a frame. The duration of a field is approximately 1/60 of a second in NTSC and 1/50 or 1/60 of a second in PAL. **f)** One half of a complete interlaced video picture (frame), containing all the odd or even scanning lines of the picture.

Field Alias – An alias caused by interlaced scanning. See also Interlace Artifacts.

Field Blanking – Refers to the part of the signal at the end of each field that make the vertical retrace invisible. Also called vertical blanking.

Field DCT Coding – Discrete cosine transform coding in which every block consists of lines from one field. The chrominance blocks in the 4:2:0 format must never be coded by using field DCT coding, but it is allowed to use field-based prediction for this type of block.

Field, Depth of – **a)** The range of distance in subject space within which a lens (or a system) provides an image that reproduces detail with an acceptably small circle of confusion (acceptable focus) usually small enough for subjective evaluation as a “point,” defines the depth of field. Tables are calculated for lenses as a function of optical aperture and the subject distance at which they are focused. Regrettably, these calculations are strictly geometric (ignoring the possibility of diffraction effects, of all optical aberrations, and of possible differing contributions to focal length from different annuli of the optical system). Thus, the tables are at times

overly optimistic. **b)** Depth of field for a given imaging system decreases with increasing optical aperture of that system, and decreases as the distance to the subject decreases. A “maximum acceptable” diameter for the “circle of confusion” may depend upon the resolution capabilities of the light-sensitive receptor (electronic or photographic) and of the system with which it is functioning. Quantitative measurements for actual imaging systems may be made on an optical bench. Practical determinations are made from subjective examination of the actual images in the system of interest.

Field Dominance – When a CAV laserdisc is placed in the still frame mode, it continuously plays back two adjacent fields of information. There are no rules in the NTSC system stating that a complete video picture has to start on field 1 or field 2. Most of the video in this program is field 1 dominant. There are two sections of the disc that are field 2 dominant. In the case of film translated to video, the start of a complete film picture changes from field 1 to field 2 about 6 times a second. There is a code in the vertical interval of the disc that tells the player on which field it can start displaying each of the disc’s still frames.

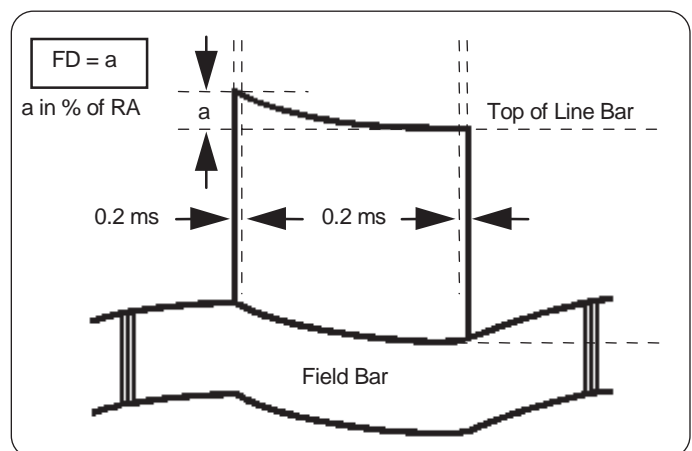
Field Frequency – The rate at which one complete field is scanned, normally 59.94 times a second in NTSC or 50 times a second in PAL.

Field Period – The reciprocal of twice the frame rate.

Field Picture – A picture in which the two fields in a frame are coded independently. Field pictures always come in sets of two fields, which are called top field and bottom field, respectively. When the first field is coded as a P- or a B-picture, the second picture must be coded in the same manner; however, if the first field is coded as an I-picture, the second field may be coded as either an I-picture or a P-picture (that is predicted from the first field).

Field Rate – Number of fields per second.

Field Time Linear Distortions – Distortions involving signals in the 64 μ sec to 16 msec range. Field time distortions cause field-rate tilt in video signals as shown in the figure below. Error is expressed in IRE or as a percentage of a reference amplitude which is generally the amplitude at the center of the line bar. Distortion can also be expressed as the K Factor of $K_{60\text{Hz}}$. See $K_{60\text{Hz}}$.



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These distortions will cause top to bottom brightness inaccuracies in large objects in the picture. These distortions can be measured with either a window signal or a field square wave. See Linear Distortions.

Field Time Waveform Distortions – See Field Time Linear Distortions.

FIFO (First-In-First-Out) – **a)** A memory structure in which data is entered at one end and removed from the other. A FIFO is used as a buffer to connect two devices that operate asynchronously. **b)** A storage device (parallel shift register) which operates as a Turing machine to buffer asynchronous data where the first data stored is the first data read out. FIFOs are used to store video and act as “rubber-band” type buffers to keep a steady video stream where memory and system clock speeds do not match. FIFOs have less delays than standard shift registers as input and output are controlled by separate clocks.

Figure-8 Microphone – A microphone (usually a ribbon type) whose sensitivity is greatest to front and rear, and weakest to both sides.

File – A container in which you store information such as text, programs, or images.

File System – A hierarchy of directories and files. Directories contain other directories and files; files cannot contain directories. The root (/) directory is at the top of the hierarchy.

Fill – The video information that replaces a “hole” (video information) cut in the video picture by the key signal.

Fill (Insert) Video – A video signal which replaces a “hole” (video information) cut in background video by a key source.

Fill Bus – A separate bus or buses from which fill videos can be selected independently from the key source cutting the hole.

Fill Light – Fill lights, commonly referred to as “scoops,” provide a soft-edged field of light used to provide additional subject illumination to reduce harsh shadows or areas not highlighted by the key light.

Film Chain – **a)** Projectors, multiplexers, and cameras connected for the purpose of transferring film to video. **b)** A device that transfers a film image to a video image. It is also known as a Telecine chain.

Film Loop – A piece of film, quite short, which is to be played repeatedly.

Filter – A device used to remove or pass certain frequencies from a signal. Low-pass filters pass the low-frequency content of a signal while high-pass filters pass the high-frequency content. A bandpass filter passes frequencies within a certain “band.”

Filter Artifacts – Distortions introduced by filters. The most common visual artifacts introduced by filters are reduced resolution and ringing.

Filter, Brick Wall – A low-pass filter with a steep cut-off (such as 20 dB/octave or greater), such that a negligible amount of higher frequency information passes. The filter typically has uniform group delay.

Filter, Gaussian – A low-pass filter providing a gradual attenuation of the higher frequencies. Strictly the attenuation should follow the curve $V = e^{-(af)^2}$. But the term is also applied to attenuation functions that only qualitatively resemble the precise power function.

Filter, Optical – In addition to the familiar optical filters for modifying spectral energy distribution, and thereby color rendition, optical filters are

also produced as low-pass filters for spatial detail in an optical image, eliminating high-frequency information that would exceed the Nyquist limit of the system and produce excessive aliasing. Many of these filters are cut from optically birefringent crystals and function by providing multiple images slightly displaced one from another so that fine detail is blurred (i.e., low-pass filtered).

Finite Impulse Response Filter (FIR) – A digital filter that is, in general, better than analog filters but also more complex and expensive. Some specialized filter functions can only be accomplished using a FIR.

FIP – Forward Interaction Path.

FIR – See Finite Impulse Response Filter.

FireWire (IEEE P1394) – At this writing, the hottest new technology in video. FireWire is a special high-speed bus standard capable of over 100 Mb/s sustained data rate.

Firmware – Program stored in ROM. Normally, firmware designates any ROM-implemented program.

First-Frame Analysis – A transparency technique wherein the first frame of the video file is a dummy frame that supplies the color or range of colors to be rendered as transparent: the color of the chroma-key background, for example. See Transparency, Transparency Frame.

FITS (Functional Interpolating Transformation System) – A format that contains all data used to design and assemble extremely large files in a small, efficient mathematical structure.

Five Step Stair Case – Test signal commonly used to check luminance gain linearity.

Fixed-Point Representation – Number representation in which the decimal point is assumed to be in a fixed position.

Flag – **a)** A variable which can take one of only two values. **b)** Information bit that indicates some form of demarcation has been reached, such as overflow or carry. Also an indicator of special conditions such as interrupts.

Flags – Menu functions other than the X, Y, or Z parameters which turn on/off or enable a selection of one or more system conditions.

Flanging – Another name for phasing. Originally, the method of phasing where phase was varied by resting your thumb on the flanges of the reel to slow it down.

Flash – Momentary interference to the picture of a duration of approximately one field or less, and of sufficient magnitude to totally distort the picture information. In general, this term is used alone when the impairment is of such short duration that the basic impairment cannot be recognized. Sometimes called “Hit.”

Flash Analog to Digital Converter – A high-speed digitizing device based on a bank of analog comparators. The analog value to be digitized is the input to one side of the comparators bank. The other comparators input is tied to a tap of a resistor ladder, with each comparator tied to its own tap. The input voltage at each comparator will be somewhere between the top and bottom voltages of the resistor ladder. The comparators output a high or a low based on the comparison of the input voltage to the resistor ladder voltage. This string of 1s and 0s are converted to the binary number.

FlashPix – A multi-resolution image format in which the image is stored as a series of independent arrays. Developed by Kodak, Hewlett-Packard, Live Picture, Inc., and Microsoft and introduced in June 1996.

Flat Field – As used herein, the entire area viewed by a television camera with the viewed area being uniformly white or any single specified color or any shade of gray.

Flat Shading – A polygon rendered so that its interior pixels are all the same color has been rendered with “flat” shading. An object represented by polygons that is rendered with flat shading will look distinctly faceted. No highlights or reflections are visible.

Flatten – The process of converting a Macintosh file into a self-contained, single-forked file so that it is compatible with Windows environment. See Self-Contained, Single-Forked.

Flicker – **a)** Flicker occurs when the refresh rate of the video is too low and the light level on the display begins to decrease before new information is written to the screen to maintain the light level. To prevent the human eye from seeing flicker, the screen refresh rate needs to be at least 24 frames per second. **b)** A rapid visible change in brightness, not part of the original scene. See also Flicker Frequency, Fusion Frequency, Judder, Large-Area Flicker, and Twitter.

Flicker Frequency – The minimum rate of change of brightness at which flicker is no longer visible. The flicker frequency increases with brightness and with the amount of the visual field being stimulated. In a recent study, a still image flashed on and off for equal amounts of time was found to have a flicker frequency of 60 flashes per second at a brightness of 40 foot lamberts (fL) and 70 at 500. Television sets generally range around 100 fL in peak brightness (though some new ones claim over 700). The SMPTE recommends 16 fL for movie theater screens (though this is measured without film, which reduces the actual scene brightness by at least 50 percent). One reason for interlaced scanning is to increase television’s flashing pictures to the flicker frequency, without increasing bandwidth.

Flip – Special effect in which the picture is either horizontally or vertically reversed.

Floating – Logic node that has no active outputs. Three-state bus lines, such as data bus lines, float when no devices are enabled.

Floating-Point Representation – Technique used to represent a large range of numbers, using a mantissa and an exponent. The precision of the representation is limited by the number of bits allocated to the mantissa. See Mantissa and Exponent.

Floppy Disk – Mass-storage device that uses a flexible (floppy) diskette to record information. See Disk.

Flowchart or Flow Diagram – Graphical representation of program logic. Flowcharts enable the designer to visualize a procedure. A complete flowchart leads directly to the final code.

FLSD (Fixed Linear Spline Data) – The different modes used to animate a value, for example, position, color, or rotation.

Fluid Head – Refers to a tripod mount that contains lubricating fluid which decreases friction and enables smooth camera movement.

Flutter – Distortion which occurs in sound reproduction as a result of undesired speed variations during recording or reproducing. Flutter occurring at frequencies below approximately 6 Hz is termed “wow.”

Flux – Magnetic field generated by a record head, stored on magnetic tape, and picked up by the playback head. Also the magnetic field that exists between the poles of a magnet.

Flux Transition – A 180-degree change in the flux pattern of a magnetic medium brought about by the reversal of the magnetic poles within the medium.

Flux Transition Density – Number of flux transitions per track length unit.

Fly-Back – See Horizontal Retrace.

Flying Erase Head – The erase head mounted on the spinning (flying) video head drum. Facilitates smooth, seamless edits whenever the camcorder recording begins. Without a flying erase head, a video “glitch” may occur at scene transitions.

Flying Head – A video head that engages when the video deck is on “pause,” providing a clear still-frame image.

Fly-Through – A fly-through is a type of animation where a moving observer flies through a seemingly stationary world.

FM – See Frequency Modulation.

FM Recording – The data signal is used to modulate the frequency of a “carrier” having a frequency much higher than any spectral component of the data signal. Permits the recording of DC or very low signal frequencies.

FM-FM – Dual carrier FM-coded discrete stereo transmissions, analogue. Can be used for bi-lingual operation under user selection, but no auto-selection is available. Audio characteristics better than standard mono soundtrack.

FMV – See Full Motion Video.

Focus – Adjustment made to the focal length of the lens, designed to create a sharper, more defined picture.

Following (or Trailing) Blacks – A term used to describe a picture condition in which the edge following a white object is overshadowed toward black. The object appears to have a trailing black border. Also called “trailing reversal.”

Following (or Trailing) Whites – A term used to describe a picture condition in which the edge following a black or dark gray object is overshadowed toward white. The object appears to have a trailing white border. Also called “trailing reversal.”

Font – A style of type. Many character generators offer the user a menu of several fonts.

Foot Candles – A measure of the amount of light falling on an object (its illumination). This is a measure only of the light energy that can be seen by the human eye (becoming an obsolete unit; replaced by the Lux).

1 foot candle = 1 lumen per square foot

Foot Lamberts – A measurement of the brightness of an object. If 100 foot candles are illuminating a 60% white chip, its brightness will be 60 foot lamberts, regardless of viewing distance. Again, remember that

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brightness is measured over the same energy response of a human eye (becoming an obsolete unit; replaced by the Nit).

Footprint – Area on earth within which a satellite's signal can be received.

Forbidden – The term forbidden when used in the clauses defining the coded bit stream indicates that the value shall never be used. This is usually to avoid emulation of start codes.

Forbidden Value – An excluded value in the coded bit stream. A value that is not allowed to appear in the bit stream.

Forced Display – A DVD feature that forces the display of a sub-picture regardless of whether or not the user wanted the sub-picture to be displayed. This would be used, for instance, in an English movie in which there were non-English words spoken and it was desired that a translation be provided even if the subtitle system was turned off.

Forced Updating – **a)** The process by which macroblocks are intra coded from time-to-time to ensure that mismatch errors between the inverse DCT processes in encoders and decoders cannot build up excessively. **b)** The recurrent use of I-coding to avoid build-up of errors between the inverse DCT processes in encoders and decoders.

Foreground (FGND) – May be thought of as the front layer of video in a picture. Also used to describe the insert video (on 4100 series) of a key.

Form – A window that contains buttons that you must click and/or editable fields that you must fill in.

Format – **a)** The configuration of signals used for interconnecting equipment in a specified system. Different formats may use different signal composition, reference pulses, etc. A variety of formats are used to record video. They vary by tape width (8 mm, 1/2", 3/4", 1"), signal form (composite, Y/C, component), data storage type (analog or digital) and signal standard (PAL, NTSC, SECAM). **b)** For data storage media (hard disks, floppies, etc.), the process of initializing the media prior to use. Formatting effectively deletes any data that was previously on the media. See Format Disk.

Format Conversion – The process of both encoding/decoding and resampling of digital rates to change a digital signal from one format to another.

Format Converter – A device that allows the reformatting of a digital data stream originating from one sampling structure (lines per frame, pixels per line) into a digital data stream of another sampling structure for the purposes of recording or passing the original data stream through distribution devices designed to accommodate the latter structure. Since the data still represents the original sampling structure, this is not the same as standards conversion.

Format Disk – The process of preparing a disk for data storage by determining where data is to be placed and how it is to be arranged on disk.

Forward Compatibility – A decoder is able to decode a bit stream coming from an encoder of a previous generation. A new coding standard is forward compatible with an existing coding standard if new decoders (designed to operate with the new coding standard) continue to be able to decode bit streams of the existing coding standard.

Forward Motion Vector – Information that is used for motion compensation from a reference picture at an earlier time in display order.

Four-Track or Quarter-Track Recoding – The arrangement by which four difference channels of sound may be recorded on quarter-inch-wide audio tape. These may be recorded as four separate and distinct tracks (monophonic) or two stereo pairs of tracks. Tracks 1 and 3 are recorded in the "forward" direction of a given reel, and Tracks 2 and 4 are recorded in the "reverse" direction.

FP – Fixed Part.

FPGA – Field-Programmable Gate Array.

FPLL – Frequency- and Phase-Locked Loop.

Fractals – Mathematically generated descriptions (images) which look like the complex patterns found in nature (e.g., the shoreline and topographic elevations of a land mass as seen from an aerial photograph). The key property of fractal is self-similarity over different domain regions.

Fragmentation – The scattering of data over a disk caused by successive recording and deletion operations. Generally this will eventually result in slow data recall, a situation that is not acceptable for video recording or replay. The slowing is caused by the increased time needed to randomly access data. With such stores, defragmentation routines arrange the data (by copying from one part of the disk to another) so that it is accessible in the required order for replay. Clearly any change in replay, be it a transmission running order or the revision of an edit, could require further defragmentation. True random access disk stores, able to play frames in any order at video rate, never need defragmentation.

Frame – **a)** A frame consists of all the information required for a complete picture. For interlaced scan systems, there are two fields in a frame. For progressive video, these lines contain samples starting from one time instant and continuing through successive lines to the bottom of the frame.

b) A complete picture composed of two fields. In the NTSC system, 525 interlaced horizontal lines of picture information in 29.97 frames per second. In the PAL system, 625 interlaced horizontal lines of picture information in 25 frames per second. **c)** The metal cabinet which contains the switcher's circuit boards. **d)** One complete video image, containing two fields. There are 30 frames in one second of NTSC video.

Frame Buffer – **a)** A block of digital memory capable of buffering a frame of video. The amount of memory required for a frame buffer is based on the video being stored. For example to store a 640 X 480 image using the RGB color space with eight bits per color, the amount of memory required would be: $640 \times 480 \times 3 = 921,600$ bytes. **b)** A frame buffer is a digital frame store, containing a large chunk of memory dedicated to pixel memory, at least one complete frame's worth. All the pixels in the buffer have the same depth. Each bit of depth is called a bit plane. Frame buffers can use the bit planes in a variety of ways. First, a pixel's bits can store the RGB values of colors. This simple method is called full-color mode. In full-color mode, it is common to refer to the red plane, or the blue or green plane, meaning the bits reserved for specifying the RGB components of the pixel. Full-color systems may also have an alpha channel, which encodes the transparency of each bit. The alpha channel is like a matte or key of the image. Alternately, the bits can store a color number, which selects the final color from a color map. Finally, some bit planes may be reserved for use as overlay planes.

Frame Capture (Frame Grabber) – Taking one frame of video and storing it on a hard drive for use in various video effects.

Frame DCT Coding – DCT coding in which every block consists of lines from both fields which are interlaced. The chrominance blocks in the 4:2:0 format always have to be coded by using frame DCT coding.

Frame Frequency – The rate at which a complete frame is scanned, nominally 30 frames per second.

Frame Period – The reciprocal of the frame rate.

Frame Picture – A picture in which the two fields in a frame are merged (interlaced) into one picture which is then coded.

Frame Rate – a) The rate at which frames of video data are scanned on the screen. In an (M) NTSC system, the frame rate is 29.97 frames per second. For (B, D, G, H, I) PAL, the frame rate is 25 frames per second.

b) The number of frames per second at which a video clip is displayed.

c) The rate at which frames are output from a video decoding device or stored in memory. The NTSC frame rate is 30 frames/second while some graphics frame rates are as high as 100 frames/second.

Frame Rate Conversion – The process of converting one frame rate to another. Examples include converting the (M) NTSC frame of 29.97 frames per second to the PAL frame rate of 25 frames per second.

Frame Relay – A network interface protocol defined by CCITT Recommendation I.122 as a packet mode service. In effect it combines the statistical multiplexing and port sharing of X.25 packet switching with the high speed and low delay of time division multiplexing and circuit switching. Unlike X.25, frame relay implements no layer 3 protocols and only the so-called core layer 2 functions. It is a high-speed switching technology that achieves ten times the packet throughput of existing X.25 networks by eliminating two-thirds of the X.25 protocol complexity. The basic units of information transferred are variable-length frames, using only two bytes for header information. Delay for frame relay is lower than X.25, but it is variable and larger than that experienced in circuit-switched networks.

Frame Roll – A momentary vertical roll.

Frame Store – Term used for a digital full-frame temporary storage device with memory for only one frame of video.

Frame Synchronizer – A digital buffer, that by storage, comparison of sync information to a reference, and time release of video signals, can continuously adjust the signal for any timing errors. A digital electronic device which synchronizes two or more video signals. The frame synchronizer uses one of its inputs as a reference and genlocks the other video signals to the reference's sync and color burst signals. By delaying the other signals so that each line and field starts at the same time, two or more video images can be blended, wiped, and otherwise processed together. A TBC (Time Base Controller) takes this a step further by synchronizing both signals to a stable reference, eliminating time-base errors from both sources. The Digital Video Mixer includes a frame synchronizer and dual TBCs.

Free-Run – Process of allowing a digital circuit (typically a microprocessor) to run without feedback (open-loop). This is done to stimulate other devices in the circuit in a recurring and predictable manner.

Freeze Frame – Special effect in which the picture is held as a still image. It is possible to freeze either one field or a whole frame. Freezing one field provides a more stable image if the subject is moving, however, the resolution of the video image is half that of a full frame freeze. Digital freeze frame is one special effect that could be created with a special effects generator or a TBC (Time Base Controller). The Digital Video Mixer includes this feature.

French Proposals – Three HDEP proposals, two closely related, suggested by a number of French organizations. For countries with a field rate of 50 fields per second, there would be 1200 scanning lines, 1150 of them active. For countries with a field rate of 59.94 fields per second, there would be 1001 scanning lines, 970 of them active. Both systems would have identical line rates (60,000 lines per second) and bandwidths (65 MHz luminance), and would be progressively scanned. This correspondence would allow a great deal of common equipment, as Recommendation 601 does for digital component video. The third proposal is for a worldwide standard based on 1050 scanning lines (970 active), 2:1 interlace, and 100 field per second.

Frequency – The number of cycles a signal that occurs per second, measured in hertz (repetition rate). In electronics, almost invariably the number of times a signal changes from positive to negative (or vice versa) per second. Only very simple signals (sine waves) have a single constant frequency; the concept of instantaneous frequency therefore applies to any transition, the frequency said to be the frequency that a sine wave making the same transition would have. Images have spatial frequencies, the number of transitions from dark to light (or vice versa) across an image, or per degree of visual field.

Frequency Allocation Table – List of which frequencies can be used for transmission of different signals in the U.S. It may require revision for certain ATV (Advanced TV) schemes. A similar function is performed internationally by the International Frequency Registration Board (IFRB), like the CCIR, part of the International Telecommunications Union.

Frequency Interleaving – The process by which color and brightness signals are combined in NTSC.

Frequency Modulation – a) Modulation of sine wave or “carrier” by varying its frequency in accordance with amplitude variations of the modulating signal. **b)** Also referring to the North American audio service broadcast over 88 MHz to 108 MHz.

Frequency Multiplex – See Multiplex.

Frequency Response – a) The range of frequencies which a piece of equipment can process. **b)** A system's ability to uniformly transfer signal components of different frequencies without affecting their amplitudes. This parameter is also known as gain/frequency distortion or amplitude versus frequency response. The amplitude variation maybe expressed in dB, percent, or IRE. The reference amplitude (0 dB, 100%) is typically the white bar or some low frequency. Frequency response numbers are only meaningful if they contain three pieces of information: the measured amplitude, the frequency at which the measurement was made, and the reference frequency. There are a number of test signals that can be used to evaluate frequency response. They include Multiburst, Multipulse, a swept signal, or (Sin X)/X.

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Frequency Response Curve – The curve relating the variation in output with frequency of a piece of equipment or magnetic tape when the input is kept constant.

Frequency Response Roll-off – A distortion in a transmission system where the higher frequency components are not conveyed at their original full amplitude. In video systems, this causes loss of color saturation.

Frequency Synthesizer – An electronic circuit that generates a number of frequencies from a fixed-reference frequency. Some frequency synthesizers generate only a relatively small number of frequencies; others generate hundreds of different frequencies.

Fringing – The pickup of extra bass frequency signals by a playback head when reproducing a signal recorded by a head with a wider track configuration, such as playing a full-track tape with a half-track head.

From Source – VTR or other device that is generating the video/audio signal that is being dissolved or wiped away from.

Front Porch – The portion of the video signal between the end of active picture time and the leading edge of horizontal sync. See Horizontal Timing.

Front-to-Back Ratio – The ratio between a cardioid microphone's sensitivity to sounds arriving from the front and from the rear, a measure of its directionality.

FSS – Fixed Satellite Services.

FST – Fast Slant Transform.

FT – Fixed Termination.

FTP (File Transfer Protocol) – A client-server protocol which allows users to transfer files over a TCP/IP network. FTP is also the name for the client program the user executes to transfer files. Though it was once the only way to download files on the Internet, it has now been integrated into many web browsers.

FTTC – Fiber to the Curb.

FTTH – Fiber to the Home.

FUCE – Full compatible EDTV. A Hitachi ATV scheme filling a Fukinuki hole for increased luminance detail, with recent proposed additions to increase chroma detail.

Fukinuki – Takahiko Fukinuki and the Fukinuki Hole named for him. Fukinuki is a Hitachi researcher who proposed filling an apparently unused portion of the NTSC spatio-temporal spectrum with additional information that might be used for ATV. The signal that fills a Fukinuki hole is sometimes referred to as a Fukinuki subcarrier. It is extremely similar to the color subcarrier and can cause an effect like cross-luminance under certain conditions.

Full Field – All sampled points in the digital component signal as opposed to active picture (AP) which are all sampled points in the digital component signal with the exception of the points between EAV and SAV.

Full Field Signals – Signals with video on each line of active video. These signals can only be used for out-of-service testing.

Full Field Testing – See Out-of-Service Testing.

Full Motion Video (FMV) – Video that plays at 30 frames per second (NTSC) or 25 frames per second (PAL).

Full Track Recording – Recording monophonically on one track whose width is essentially the same as the tape's.

Full-Color Mode – Full-color mode is distinguished by: each pixel contains its own values; a full-color render takes about three times as long as color mapped render. Anti-aliasing, transparency, and texture mapping are possible only in this mode. Full-color mode makes possible such things as transparency, texture mapping, and anti-aliasing.

Fusion Frequency – The minimum rate of presentation of successive images of a motion picture that allows motion to seem smooth, rather than jerky. The fusion frequency is almost always lower than the flicker frequency. As it applies to the rate at which images are presented, rather than the rate at which they were shot, material that appears to be at or above the fusion frequency when viewed at normal speed may be below it when viewed in slow motion. Techniques to smooth motion presented at a rate below the fusion frequency have been developed for such purposes as computer-assisted animation; these are sometimes called in-betweening techniques. See also Judder.

Future Reference Picture – A future reference picture is a reference picture that occurs at a later time than the current picture in display order.

► **G**

G.711 – This ITU recommendation defines an 8-bit A-law (European companding) and μ -law (American companding) PCM audio format with 8 kHz sampling used in standard telephony. G.711 audio is also used in H.320 videoconferencing.

G.722 – An ITU-T recommendation which embraces 7 kHz audio coding at 64 kbit/s. G.722 uses an adaptive differential PCM (ADPCM) algorithm in two sub-bands, and is widely used for news and sports commentary links. The sound quality is normally considered inferior compared to MPEG audio coding, but has the advantage of low coding delay in comparison with MPEG. Due to the low delay, and because of the large installed base of G.722 equipment, the algorithm will continue to be in service.

G.726 – This ITU-T recommendation is entitled “40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM).” It defines the conversion between 64 kbit/s A-law or μ -law PCM audio and a channel of the rates stated in the title, by using ADPCM transcoding.

G.728 – This ITU-T recommendation defines coding of speech at 16 kbit/s based on code-excited linear prediction (CELP). The delay of about 2 ms in G.728 is lower than other typical implementations of this type of coding. G.728 audio is used in H.320 videoconferencing.

GA – See Grand Alliance.

Gain – **a)** Any increase or decrease in strength of an electrical signal. Gain is measured in terms of decibels or number of times of magnification.

b) The ratio of output power to the input power for a system or component.

c) The amount of amplification of a circuit. The term gain is often used incorrectly to denote volume and loudness which are psychological factors which are the results of “gain.”

Gain Ratio Error – In a three-wire interconnect CAV system, the gain of one signal may be higher or lower than what it should be because of gain distortion caused by one channel. This will cause the ratio of signal amplitudes to be incorrect. This error manifests itself as color distortions. In some cases, errors in gain ratio will generate illegal signals (see the discussion on Illegal Signals). The distorted signal may be legal within its current format but could become illegal if converted into a different component format.

Gain/Frequency Distortion – Distortion which results when all of the frequency components of a signal are not transmitted with the same gain or loss. A departure from “flatness” in the gain/frequency characteristic of a circuit. Refer also to the Frequency Response discussion.

Gamma – Since picture monitors have a nonlinear relationship between the input voltage and brightness, the signal must be correspondingly pre-distorted. Gamma correction is always done at the source (camera) in television systems: the R, G, and B signals are converted to $R\ 1/g$, $G\ 1/g$, and $B\ 1/g$. Values of about 2.2 are typically used for gamma. Gamma is a transfer characteristic. Display devices have gamma (or at least CRTs do). If you measure the actual transfer characteristic of a CRT used for either

television display or computer display, you will find it obeys a power law relationship:

$$\text{Light} = \text{Volts}^{\gamma}$$

where gamma is 2.35 plus or minus 0.1. CRTs have values between 2.25 and 2.45 – 2.35 is a common value. It is a function of the CRT itself, and has nothing to do with the pictures displayed on it. CRT projectors are different; green tubes are typically 2.2 while red is usually around 2.1 and blue can be as low as 1.7. But there are no direct-view CRTs which have values lower than 2.1. Pictures which are destined for display on CRTs are gamma-corrected which means that a transfer characteristic has been applied in order to try to correct for the CRT gamma. Users of TV cameras have to accept the characteristic supplied by the manufacturer, except for broadcasters who have adjustable camera curves (the video engineers adjust the controls until they like the look of the picture on the studio monitor in their area). Even so, no TV camera uses a true gamma curve; they all use rather flattened curves with a maximum slope near black of between 3 and 5. The higher this slope, the better the colorimetry but the worse the noise performance.

Gamma Correction – **a)** The RGB data is corrected to compensate for the gamma of the display. **b)** Historically, gamma correction was a precompensation applied to the video signal at the camera to correct for the nonlinearities of the CRT (i.e., power function of the electron gun) and, as such, it was the inverse of the electron gun function. It is now widely used, however, to describe “the total of all transfer function manipulations” (i.e., including the departures from a true power law function), whether inherent or intentionally introduced to act upon the video signal for the purpose of reducing the bandwidth for signal processing, making the image on the final display conform to preconceived artistic objectives, and/or providing noise suppression, or even bit rate reduction. **c)** The insertion of a nonlinear output-input characteristic for the purpose of changing the system transfer characteristic. As this usage has grown, the IEEE definition correlating gamma to an analytical function becomes optimistic. **d)** An adjustment factor used to correct an image’s intensity when it is displayed. Display devices can perform gamma correction but raster images can also be gamma corrected with software prior to display.

Gamma Ferric Oxide – The common magnetic constituent of magnetic tapes in the form of a dispersion of fine acicular particles within the coating.

Gamma, Electronic – **a)** The exponent of that power law that is used to approximate the curve of output magnitude versus input magnitude over the region of interest. **b)** Video – The power function of the electro gun in a CRT. It has become customary in video, as in photography, to extend the meaning and to use gamma as a synonym for the complete transfer function regardless of curve shape. Note: In the electronics system, increasing gamma decreases image contrast. **c)** Imaging Processing and Display – Nonlinear processing is useful in many television systems as a means of bandwidth limiting, and is normally applied at the camera. Given the pre-dominance of CRT displays, the chosen exponent is related to that of the

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electron gun (typically 2.2 for systems with 525/59.94 scanning, 2.8 for systems with 625/50 scanning, and 2.22 for SMPTE 240M).

Gamma, Photographic – a) The slope of the transfer function: density (log of reciprocal transmission) vs. log exposure. It is thus the power function correlating transmission to exposure. **b)** Gamma in the photographic sense was originally applied specifically to the straight-line portion of the transfer function. Only if all of the photographic densities corresponding to light intensities in the scene lie within that straight-line portion of the transfer function is gamma proportional to contrast. It is sometimes loosely used to indicate either an average or a point slope of the transfer function. Note: In the photographic system, increasing gamma increases image contrast.

Gamma Table – A table of constants which functions as a nonlinear amplifier to correct the electron gun drive voltages so that the CRT display appears to be linear. Because the gamma function for each color is different in a typical CRT, different values for each color are usually contained in the gamma table. This process is called Gamma Correction.

Gamut – The range of voltages allowed for a video signal, or a component of a video signal. Signal voltages outside of the range (that is exceeding the gamut) may lead to clipping, crosstalk, or other distortions.

Gap – The space between the pole pieces of a tape head.

GAP – Generic Access Profile.

Gap Depth – The dimension of the gap measured in the direction perpendicular to the surface of a head.

Gap Length – The dimension of the gap of a head measured from one pole face to the other. In longitudinal recording, the gap length can be defined as the dimension of the gap in the direction of tape travel.

Gap Loss – The loss in output attributable to the finite gap length of the reproduce head. The loss increases as the wavelength decreases.

Gap Scatter – The phenomenon of the gaps in a multitrack head not being in a straight line.

Gap Smear – This is due to head wear and is the bridging or shorting out of the record or reproduce gap as the result of flowing of the pole face material in the direction of tape motion.

Gap Width – The dimension of the gap measured in the direction parallel to the head surface and pole faces. The gap width of the record head governs the track width. The gap widths of reproduce heads are sometimes made appreciably less than those of the record heads to minimize tracking errors.

Gateway – Gateways provide functional bridges between networks by receiving protocol transactions on a layer-by-layer basis from one protocol (SNA) and transforming them into comparable functions for the other protocol (OSI). In short, the gateway provides a connection with protocol translation between networks that use different protocols. Interestingly enough, gateways, unlike the bridge, do not require that the networks have consistent addressing schemes and packet frame sizes. Most proprietary gateways (such as IBM SNA gateways) provide protocol converter functions up through layer six of the OSI, while OSI gateways perform protocol translations up through OSI layer seven. See OSI Model.

Gauss – The metric unit of magnetic flux density equal to one Maxwell per square centimeter.

GBR Format – The same signals as RGB. The sequence is rearranged to indicate the mechanical sequence of the connectors in the SMPTE standard.

GCR – See Ghost Cancellation Reference Signal.

GE (General Electric) – A proponent of the ACTV schemes.

General Purpose Interface (GPI) – A standard interface for control of electronic equipment. A connector on the back of the switcher frame or editor which allows remote control of the Auto Trans, DSK Mix, Fade to Black, or Panel Memory Function or Sequence on the switcher. Usually a contact closure (i.e., switch) which provides short to ground.

General Purpose Serial Interface (GPSI) – A form of translator which allows the switcher to talk to other devices, i.e., ADO, and to be given instructions serially by devices such as Editors.

Generation – The number of duplication steps between an original recording and a given copy. A second generation duplicate is a copy of the original master and a third generation duplicate is a copy of a copy of the original master, etc.

Generation Loss – When an analog master videotape is duplicated, the second-generation copy is usually inferior in some way to the master. This degradation appears as loss of detail, improper colors, sync loss, etc. Limited frequency response of audio/video magnetic tape and imperfections in electronic circuitry are the main causes of generation loss. Higher performance formats (such as 1") exhibit much less generation loss than more basic formats. Digital formats make generation loss negligible because each copy is essentially an exact duplicate of the original. Video enhancing equipment can minimize generation loss. Some video processors pre-enhance the video signal to overcome generation loss.

Genlock – a) The process of locking both the sync and burst of one signal to the burst and sync of another signal making the two signals synchronous. This allows the receiver's decoder to reconstruct the picture including luminance, chrominance, and timing synchronization pulses from the transmitted signal. **b)** The ability to internally lock to a non-synchronous video. AVC switchers allow genlocked fades on the DSK.

Genlock Outputs – A timed color black output synchronous with the input reference video. The AVC series also provides the DSK genlocked color black. On 4100 series switchers, this also includes composite sync, sub-carrier, vertical and horizontal drive pulses, burst flag pulse, and composite blanking.

Geometric Distortion – Any aberration which causes the reproduced picture to be geometrically dissimilar to the perspective plane projection of the original scene.

Geometry – The shape of objects in a picture, as opposed to the picture itself (aspect ratio). With good geometry, a picture of a square is square. With poor geometry, a square might be rectangular, trapezoidal, pillow-shaped, or otherwise distorted. Some ATV schemes propose minor adjustments in geometry for aspect ratio accommodation.

Geostationary Orbit – Satellite orbits 22,300 miles above earth's equator where satellites circle earth at the same rate the earth rotates.

Ghost – A shadowy or weak image in the received picture, offset either to the left or right of the primary image, the result of transmission conditions which create secondary signals that are received earlier or later than the main or primary signal. A ghost displaced to the left of the primary image is designated as “leading” and one displaced to the right is designated as “following” (lagging). When the tonal variations of the ghost are the same as the primary image, it is designated as “positive” and when it is the reverse, it is designated as “negative.” See Multipath Distortion.

Ghost Cancellation Reference (GCR) Signal – ITU-R BT.1124 standard reference signal found on scan lines 19 and 282 of (M) NTSC systems and on line 318 (B, D, G, H, I) of PAL systems. This signal allows for the removal of ghosting from TVs by filtering the entire transmitted signal based on the condition of the transmitted GCR signal.

Ghost Point – A supplementary point included on the tangent to the acquired point in order to force the line to begin and end on the acquired points.

Ghosting – A weak, secondary, ghost-like duplicate video image in a video signal caused by the undesired mixing of the primary signal and a delayed version of the same signal.

GHz (Gigahertz) – Billions of cycles per second.

Gibbs Effect – The mirage-like haze at the boundaries of picture objects, seen in DCT based compression algorithms at (too) high compression ratios. The effect is most noticeable around text and high-contrast geometrical shapes.

GIF (Graphic Interchange Format) – A bit-mapped graphics file format popular for storing lower resolution image data.

Gigabyte – One billion bytes.

Glenn – William and Karen Glenn, researchers for NYIT in Dania, Florida, who developed the VISTA ATV scheme. They are often cited for their work indicating that human vision cannot simultaneously perceive high spatial detail and high temporal detail.

Glitch – a) A form of low-frequency interference, appearing as a narrow horizontal bar moving vertically through the picture. This is also observed on an oscilloscope at field or frame rate as an extraneous voltage pip moving along the signal at approximately reference black level. **b)** Slang for visual error, i.e., dropout on tape, spikes at switcher pattern boundaries. Patterns that jump off screen or any other aberration. **c)** Slang for a fault in data transmission or other error that does not cause a total lock up.

Glitch Impulse – A term used to define the voltage/time function of a single DAC step until the output video level has settled to within ± 1 LSB of the final value. Glitches are apt to appear in output video as the input to the DAC changes from:

0111 1111 to 1 000 0000

Global Data Set – A data set with all data essence or metadata elements defined in the relevant data essence standard or Dynamic Metadata Dictionary.

Global (Menu) – A separate channel that allows additional rotations to be superimposed on an image and, in 3D systems, “motion on motion” in an effect.

Gloss Level – A shiny surface imparted to the magnetic coating due to calendaring.

GMSK – Gaussian Filtered Minimum Shift Keying.

GOP (Group of Pictures) – a) A GOP starts with an I-picture and ends with the last picture before the next I-picture. **b)** A picture sequence which can be coded as an entity. For instance, it is possible to cut between GOPs. For that reason, the first picture in a GOP has to be intra-coded (I-picture). Time codes are carried on GOP levels.

Gouraud Shading – This type of smooth shading has no true “specular” highlights and is faster and cheaper than Phong shading (which does).

GPI/GPO – General Purpose Input/General Purpose Output.

Grand Alliance (GA) – The United States grouping, formed in May 1993, to produce “the best of the best” initially proposed HDTV systems. The participants are: AT&T, General Instrument Corporation, Massachusetts Institute of Technology, Philips Consumer Electronics, David Sarnoff Research Center, Thomson Consumer Electronics, and Zenith Electronics Corporation. The format proposed is known as the ATSC format.

Graphic Equalizer – An equalizer which indicates its frequency response graphically through the position of its controls. When the controls are in a straight line at the 0 position, the response is flat.

Graphics Board – The printed circuit board within a workstation that contains the graphics processors.

Gray Card – A nonselective (color neutral) diffuse reflector intended to be lighted by the normal illumination of the original scene, and having a reflectance factor of 18% (compared with a perfect reflector at 100% and prepared magnesium oxide at 98%). The gray card luminance is used as a guide in determining scene exposure so that the image is placed upon the most favorable portion of the transfer function curve.

Gray Scale – a) The luminance portion of the video signal. A scale of 10 from TV black to TV white indicating the shades of gray a camera can see at any one time and to which a camera can be adjusted. A gray scale adjustment of 7 is good. **b)** An optical pattern in discrete steps between light and dark. Note: A gray scale with ten steps is usually included in resolution test charts.

Green Tape – An abrasive tape used to clean and lap heads that are unevenly worn, stained, scratched, etc. Should be used with caution and should not be used on ferrite heads. This also applies to gray tape.

Ground – A point of zero voltage potential. The point in reference to which all voltages are measured.

Ground Loop – Hum caused by currents circulating through the ground side of a piece of equipment due to grounding different components at points of different voltage potential.

Grounded Electrical Outlet – An electrical wall outlet that accepts a plug that has a grounding prong. In the USA, all properly wired three-prong outlets provide a ground connection.

Group – A group is any arbitrary collection of polygons; a subset of the database, usually the group represents a coherent object. A group could contain all the polygons constituting the model of a chair, or it could con-

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tain twenty such chairs and a table. A polygon can only be in one group at a time, but it can move to another group.

Group 1, 2, 3, and 4 – The ITU-T Group 1 to 4 specify compression of black and white documents and the operation of facsimile equipment. Group 3 (also known as G3 or T.4) is presently the most important standard in the world of fax and document storage applications. G3 compression features modified Huffman encoding. The ITU-T Group 4 (also known as G4 or T.6) is an improvement of ITU-T G3, dedicated to digital telephone lines, in particular ISDN.

Group Delay – a) A signal defect caused by different frequencies having differing propagation delays. **b)** This distortion is present when signal components of different frequencies experience different delays as they pass through a system. Distortions are expressed in units of time. The largest difference in delay between a reference low frequency and the other frequencies tested is typically quoted as the group delay distortion. Group delay problems can cause a lack of vertical line sharpness due to lumi-

nance pulse ringing, overshoot, or undershoot. The Multipulse or $(\sin x)/x$ signals can be used to check for group delay in the same way as these signals are used to check for chrominance to luminance delays.

GSM – Global System for Mobile Communication.

GSTM – General Switched Telephone Network.

Guard Interval – Additional safety margin between two transmitting symbols in the COFDM standard. The guard interval ensures that reflections occurring in the single-frequency network are eliminated until the received symbol is processed.

Guest – A modeling object visualized in the presence of another database which will serve as a visualization support but cannot be modified.

GUI (Graphical User Interface) – A computer interface that allows the user to perform tasks by pointing to icons or graphic objects on the screen. Windows is a graphics user interface. Most multimedia programs require GUIs.

▶ **H**

H Drive – See Horizontal Drive.

H Rate – The time for scanning one complete horizontal line, including trace and retrace. NTSC equals 1/15734 seconds (color) or 63.56 μ sec.

H.222 – This ITU-T recommendation is identical to the audio specification of MPEG-2.

H.261 – Recognizing the need for providing ubiquitous video services using the Integrated Services Digital Network (ISDN), CCITT (International Telegraph and Telephone Consultative Committee) Study Group XV established a Specialist Group on Coding for Visual Telephony in 1984 with the objective of recommending a video coding standard for transmission at $m \times 384$ kbit/s ($m = 1, 2, \dots, 5$). Later in the study period after new discoveries in video coding techniques, it became clear that a single standard, $p \times 64$ kbit/s ($p = 1, 2, \dots, 30$), can cover the entire ISDN channel capacity. After more than five years of intensive deliberation, CCITT Recommendation H.261, Video Codec for Audio Visual Services at $p \times 64$ kbit/s, was completed and approved in December 1990. A slightly modified version of this Recommendation was also adopted for use in North America. The intended applications of this international standard are for videophone and videoconferencing. Therefore, the recommended video coding algorithm has to be able to operate in real time with minimum delay. For $p = 1$ or 2, due to severely limited available bit rate, only desktop face-to-face visual communication (often referred to as videophone) is appropriate. For $p >= 6$, due to the additional available bit rate, more complex pictures can be transmitted with better quality. This is, therefore, more suitable for videoconferencing. The IVS (INRIA Videoconferencing System) is a software implementation of H.261 codec which also features PCM and ADPCM audio codecs and includes an error control scheme to handle packet losses in the Internet.

H.261 – The ITU-T H.261 recommendation embraces video codecs for audio visual services at $p \times 64$ kbit/s data rate, where p is between 1 and 30. Thus, the standard is informally called “ $p \times 64$.” It is aimed at low bit rate media, and is used in the H.320 videoconferencing recommendation. H.261 provides a resolution of 352 x 288 pixels (CIF) or 176 x 144 pixels (QCIF), independent of bit rate. The H.261 recommendation defines both encoding and decoding. However, it defines, more strictly, how to decode than to encode the bit stream, and has room for options in the encoder. The coding is based on DCT with word-length encoding. H.261 defines both independently coded frames (key frames), and frames that frame by using block-based motion compensation (non-key frames). H.261 also defines error-correction codes, and it allows rate control by varying quantization and by dropping frames and jumping blocks.

H.262 – The H.262 recommendation is identical to the video specification of MPEG-2.

H.263 – An ITU-T recommendation concerning “video coding for low bit rate communication.” The H.263 is dedicated to video conferencing via H.324 terminals using V.34 modems at 28.8 kbit/s, and to H.323 LAN-based videoconferencing. The coding algorithm in H.263 is based on H.261, but has better performance than the H.261, and it may eventually displace H.261.

H.320 – An ITU-T recommendation for low bit rate visual communication. The H.320 is entitled “narrow-band visual telephone systems and terminal equipment” and is widely accepted for ISDN videoconferencing. The H.320 is not a compression algorithm, but is rather a suite of standards for videoconferencing. H.320 specifies H.261 as the video compression, and defines the use of one of three audio formats: either G.711, G.722, or G.728.

H.324 – ITU recommendation H.324 describes terminals for low bit rate multimedia applications, using V.34 modems operating over the general telephone system. H.324 terminals may carry real-time voice, data, and video or any combination, including video telephony. H.324 makes use of the logical channel procedures of recommendation H.245, in which the content of each logical channel is described when the channel is opened. H.324 terminals may be used in multipoint configurations through MCUs, and may interwork with H.320 terminals on ISDN, as with terminals on wireless networks.

HAD – See Half Amplitude Duration.

Half Amplitude Duration – The 50 percent point on a test waveform.

Half-Duplex Transmission – Data transmitted in either direction, one direction at a time.

Half Splitting – Troubleshooting technique used for fault isolation. It involves the examination of circuit nodes approximately midway through a circuit. Once the operational state of these nodes has been determined, the source of the fault can be isolated to the circuits either before or after this point. This process can then be continued.

Halo – **a)** Most commonly, a dark area surrounding an unusually bright object, caused by overloading of the camera tube. Reflection of studio lights from a piece of jewelry, for example, might cause this effect. With certain camera tube operating adjustments, a white area may surround dark objects. **b)** Type of pattern border with soft edges and a mix from a vid to border matte gen then to “B” vid.

Halt – Command to stop the computer.

Handshake – **a)** The protocol that controls the flow of information between two devices. **b)** Control signals at an interface in which the sending device generates a signal indicating that new information is available, and the receiving device then responds with another signals indicating that the data has been received.

Hanging Dots – A form of cross-luminance created by simple comb filters. It appears as a row of dots hanging below the edge of a highly saturated color. See also Cross-Luminance.

Hangover – Audio data transmitted after the silence detector indicates that no audio data is present. Hangover ensures that the ends of words, important for comprehension, are transmitted even though they are often of low energy.

Hard Banding – A variation in thickness or elasticity across the width of the tape, it may be a coating defect, or it may be caused by stretch damage either during manufacture or in use. It results in a variation of the

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recovered RF due to the effect on head-to-tape contact and may result in color saturation banding and velocity errors.

Hard Border – A hard border usually applies to patterns and is characterized by an abrupt change from background video to the border video and by an abrupt change from the border video to the foreground video. Also sometimes used to describe key borders with a high gain.

Hardware – **a)** Term used generically for equipment, i.e., VTRs, switchers, etc. **b)** Individual components of a circuit, both passive and active, have long been characterized as hardware in the jargon of the engineer. Today, any piece of data processing equipment is informally called hardware.

Hard-Wired Logic – See Random Logic.

Harmonic Distortion – If a sine wave of a single frequency is put into a system, and harmonic content at multiples of that frequency appears at the output, there is harmonic distortion present in the system. Harmonic distortion is caused by nonlinearities in the system.

Harmonics – **a)** Whole number multiples of a frequency. $F \times 1$ is called the fundamental or first harmonic; $F \times 2$ is the second harmonic; $F \times 3$ is the third harmonic; etc. **b)** Integral multiples of a fundamental frequency are harmonics of that frequency. A pure sine wave is free of harmonics. Adding harmonics to a fundamental frequency will change its wave shape. A square wave contains a fundamental frequency plus all the odd harmonics of that frequency.

HARP (High-Gain Avalanche Rushing Amorphous Photoconductor) – A very new type of image sensor (target) for a camera tube. HARP target tubes are about 10 times more sensitive to light than conventional tube types and have been demonstrated to offer hope of overcoming the sensitivity drawbacks of HDTV cameras.

HBF – Half Band Filter.

HBI – See Horizontal Blanking Interval.

HBO (Home Box Office) – Time Inc.'s pay-cable and entertainment production company, a co-proposer with ATC of C-HDTV and supporter of ACTV.

HD (High Definition) – A frequently used abbreviation for HDEP and sometimes HDTV. The term High Definition, applied to television, is almost as old as television itself. In its earliest stage, NTSC was considered high definition (previous television systems offered from 20 to 405 scanning lines per frame).

HD D5 – A compressed recording system developed by Panasonic which uses compression at about 4:1 to record HD material on standard D5 cassettes.

HD-0 – A set of formats based on the ATSC Table 3, suggested by the DTV Team as the initial stage of the digital television rollout.

ATSC TABLE 3
Formats for DTV Transmission
(i = interlaced, p = progressive)

Vertical Size Value (active)	Horizontal Size Value (active)	Aspect Ratio Information	Frame Rate and Scan
(HD) 1,080	1,920	16:9 (square pixel)	24p, 30p, 30i
(HD) 720	1,280	16:9 (square pixel)	24p, 30p, 60p
(SD) 480	704	4:3 non-square pixel)	24p, 30p, 30i, 60p
(SD) 480	704	16:9 (non-square pixel)	24p, 30p, 30i, 60p
(SD) 480	640	4:3 (square pixel)	24p, 30p, 30i, 60p

HD-1 – A set of formats based on the ATSC Table 3, suggested by the DTV Team as the second stage of the digital television rollout, expected to be formalized in the year 2000.

HD-2 – A set of formats based on the ATSC Table 3, suggested by the DTV Team as the third stage of the digital television rollout contingent on some extreme advances in video compression over the next five years. The added format is not part of the ATSC Table 3.

HDCAM – Sometimes called HD Betacam, is a means of recording compressed high-definition video on a tape format (1/2-inch) which uses the same cassette shell as Digital Betacam, although with a different tape formulation.

HDDR – High Density Digital Recording.

HDEP (High Definition Electronic Production) – A term bearing little or no implications for transmission and display systems. The SMPTE and the ATSC have approved one standard for HDEP, sometimes referred to as SMPTE 240M. This standard has 1125 scanning lines per frame, 60 field per second, 2:1 interlace, an aspect ratio of 16:9, extended colorimetry, and a 30 MHz base bandwidth for each of its three color components. It is based on work at NHK, but includes considerable American modifications. Clearly, the combined 90 MHz base bandwidth of this HDEP standard cannot be practically broadcast (not counting sound or modulation characteristics, it takes up as much bandwidth as 15 current broadcast channels). That is why there are so many ATV transmission schemes.

HDLC – High Level Data Link Control.

HD-MAC (High Definition MAC) – A variety of systems, all European except for HDMAC-60.

HDMAC-60 – The baseband and satellite transmission form of HDS-NA. See also MAC.

HD-NTSC – The Del Rey Group's ATV scheme, comprised primarily of a quincunx scanning scheme referred to as Tri-Scan, which would sub-sample each NTSC pixel three times, in a triangular fashion, for increased vertical and horizontal static resolution, at an effective 10 frame-per-second rate. Blanking adjustment is used for aspect ratio accommodation.

HDNTSC – The terrestrial transmission form of HDS-NA, comprised of a receiver-compatible, channel-compatible signal and an augmentation channel, which may be half-sized and low-power. The augmentation channel

carries increased resolution, improved sound, widescreen panels, and pan and scan information to let an ATV set know where to apply the panels.

HD-PRO – A universal, worldwide HDEP proposal from the Del Rey Group, said to accommodate all ATV systems. Details are not available pending patent protection.

HDS-NA (High Definition System for North America) – The Philips Laboratories (Briarcliff, NY) ATV scheme, comprised of two separate systems, HDMAC-60, a single, satellite-deliverable channel designed to get the signal to broadcast stations and CATV head-ends, and HDNTSC, a two-channel (receiver-compatible plus augmentation) system to deliver it to home TVs.

HDTV – See High Definition Television.

HDTV 1125/60 Group – An organization of manufacturers supporting the SMPTE HDEP standard.

HDVS (High Definition Video System) – A Sony trade name for its HDEP equipment and ancillary products, such as HD videodisc players.

Head – In a magnetic recorder, the generally ring-shaped electromagnet across which the tape is drawn. Depending on its function, it either erases a previous recoding, converts an electrical signal to a corresponding magnetic pattern and records it on the tape, or picks up a magnetic pattern already on the tape and converts it to an electrical playback signal.

2-Head: The system used on most cassette recorders, requiring that playback occur after the recording has been made. **3-Head:** Refers to the recording/playback head configuration within the recorder. A 3-head system allows simultaneous playback of recorded material.

Head Alignment – Mechanical adjustment of the spatial relationships between the head gaps and the tape.

Head Block – An assembly holding an erase, record, and playback head in a certain physical alignment.

Head Demagnetizer or Degausser – A device used to neutralize possible residual or induced magnetism in heads or tape guides.

Headend – Facility in cable system from which all signals originate. Local and distant television stations, and satellite programming, are picked up and amplified for re-transmission through system.

Head-End – The part of a CATV system from which signals emanate.

Header – A block of data in the coded bit stream containing the coded representation of a number of data elements pertaining to the coded data that follow the header in the bit stream.

Header/Descriptor – See Image File Header/Descriptor.

Headroom – a) The number of dB increases possible above the operation level (0 VU) before unacceptable distortion occurs. **b)** In composition, the space between a subject's head and the upper boundary of the frame.

c) The difference between the nominal level (average) and the maximum operating level (just prior to "unacceptable" distortion) in any system or device. Because it is a pure ratio, there is no unit or reference-level qualifier associated with headroom – simply "dB"; headroom expressed in dB accurately refers to both voltage and power.

Heads Out – A way of winding tape so that the beginning of a selection is on the outside of the reel.

Head-to-Tape Contact – The degree to which the surface of the magnetic coating approaches the surface of the record or replay heads during normal operation of a recorder. Good head-to-tape contact minimizes separation loss and is essential in obtaining high resolution.

Height – The vertical positioning of a head with respect to a piece of tape. The size of the picture in a vertical direction.

Helical Scan – A method of recording video information diagonally on a tape, used in home and professional VCRs. High-speed rotating video heads scan these diagonal video tracks, giving an effective tape speed much higher than the actual tape speed allowing more information to be recorded on a given length of magnetic tape.

Hertz (Hz) – The unit of frequency. Equivalent to cycles per second.

HEX (Hexadecimal) – Base-16 number system. Since there are 16 hexadecimal digits (0 through 15) and only ten numerical digits (0 through 9), six additional digits are needed to represent 10 through 15. The first six letters of the alphabet are used for this purpose. Hence, the hexadecimal digits read: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The decimal number 16 becomes the hexadecimal number 10. The decimal number 26 becomes the hexadecimal number 1A.

HFC – Hybrid Fibre Coax.

HHR (Half Horizontal Resolution) – Part of the MPEG-2/DVB standard where half of the normal 720-pixel horizontal resolution is transmitted while maintaining normal vertical resolution of 480 pixels. Since it is a 4:2:0 format, the color information is encoded at 240 pixels vertically and 176 pixels horizontally. Virtually all the DBS providers use HHR format since it dramatically reduces the bandwidth needed for channels, though at the expense of picture quality. Special logic in the video decoder chip in the set top box re-expands the picture to normal horizontal size by interpolation before display. 4:2:2 video at Standard Definition looks as good as the NBC analog feeds on GE-1 Ku. High bandwidth 4:2:0 video such as the NBC digital feeds on GE-1 Ku come very close to studio quality and the low bandwidth video encoded in HHR format looks like DBS.

Hi Con – A black and white high contrast signal used as a key source. See also Matte Reel.

Hi Impedance Mike – A mike designed to be fed into an amplifier with input impedance greater than 20 to 50 ohms.

Hi-8 – 8 mm videotape format which provides better quality than VHS. An improved version of the 8 mm tape format capable of recording better picture resolution (definition). A higher-density tape is required which provides a wider luminance bandwidth, resulting in sharper picture quality (over 400 horizontal lines vs. 240 for standard 8 mm) and improved signal-to-noise ratio. Camcorders using this format are very small, light, and provide a picture quality similar to S-VHS.

Hidden Line Removal – A wireframed object can be confusing to look at because edges that would be hidden are still displayed. Hidden line removal is the process of computing where edges are hidden and not drawing them.

Hi-Fi (High Fidelity) – Most commonly used to refer to the high quality audio tracks recorded by many VCRs. These tracks provide audio quality approaching that of a CD. However, because they are combined with the

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video signal before recording, audio dubs using them are impossible without re-recording the video.

High Definition Films – British organization that began using the term High Definition for its electronic cinematography system even before color TV was broadcast in the U.S.

High Definition Television (HDTV) – a) General term for proposed standards pertaining to consumer high-resolution TV. **b)** An ATV term sometimes confused with HDEP. HDTV is usually used to describe advanced production and delivery mechanisms that will get ATV to the home. As HDEP cannot practically be broadcast, all broadcast HDTV schemes must make compromises in quality. The line between broadcast HDTV and EDTV, therefore, is difficult to define. See Minimum Performance. **c)** A TV format capable of displaying on a wider screen (16x9) as opposed to the conventional 4x3) and at higher resolution. Rather than a single HDTV standard, the FCC has approved several different standards, allowing broadcasters to choose which to use. This means new TV sets will have to support all of them. All of the systems will be broadcast as component digital. **d)** By HDTV, we normally understand transmission, rendering, and display systems that feature about double the number of scanning lines, improved color quality, and less artifacts than that of today's composite systems. The video may be analog, like the Japanese MUSE or the European HD-MAC, or digital, like the ATSC system in the USA. The European, MPEG-2 based Digital Video Broadcasting (DVB) specifications embrace HDTV in addition to 625-line TV. In the USA, the Grand Alliance has succeeded in combining various digital HDTV systems into the ATSC system – a multiple format system based on MPEG-2 video coding – that allows HDTV transmissions to use the same frequency bands now used by regular NTSC television. The Japanese, who have had regular analog HDTV transmission for some time, are also planning to implement digital HDTV.

High Density Digital Recording (HDDR) – Recording of digital data on a magnetic medium, having a flux transition density in excess of 15,000 transitions per inch per track.

High Energy Oxide – Any magnetic oxide particle exhibiting a BSHC product higher than that of gamma ferric oxide. Chromium dioxide and cobalt are the two most common examples at the present time.

High Energy Tape – A tape made with a high energy oxide.

High Frequency Subcarrier – An information channel added to a television signal where the finest brightness detail is normally transmitted. As the human visual system is least sensitive to the finest detail, it is unlikely to be bothered by interface from such a subcarrier. This technique was first applied to the NTSC color subcarrier; most recently it has been proposed in Toshiba's ATV system.

High Level – A range of allowed picture parameters defined by the MPEG-2 video coding specification which corresponds to high-definition television.

High Line Rate – More than 525 scanning lines per frame.

High Resolution Sciences (HRS) – Proponent of the CCF ATV scheme. HRS plans to offer other ATV schemes, including one using synchronized electron beam spatial modulation (turning each scanning line into a series of hills and valleys) in both camera and receiver to achieve increased vertical resolution.

High-Frequency Distortion – Undesirable variations that occur above the 15.75 kHz line rate.

High-Frequency Interference – Interference effects which occur at high frequency. Generally considered as any frequency above the 15.75 kHz line frequency.

High-Level Language – Problem-oriented programming language, as distinguished from a machine-oriented programming language. A high-level language is closer to the needs of the problem to be handled than to the language of the machine on which it is to be implemented.

Highlight – a) In lighting, to add a light which will cause an area to have more light. **b)** In switchers, to allow one portion of the video to have a greater luminance level. **c)** In screens, monitors, displays, etc., to cause a word on the display to be brighter, commonly by inverting and surrounding the work with a box of white video.

Highlighting – In the menu system for DVDs it is necessary to be able to indicate a menu selection since there is no "computer mouse" available. This highlighting is accomplished through a wide variety of graphic arts and post-production techniques coupled with the capabilities provided by the DVD itself.

Highlights – a) Shiny areas that suggest intense reflections of light sources. Highlights move when light sources move relative to a surface, but are independent of all other lighting types. **b)** Highlights may be applied to a smooth surface by both Gouraud and Phong shading, but only the latter computes specular reflections based on the angle between reflected light from a light source and the eye's line of sight.

High-Lights – The maximum brightness of the picture, which occurs in regions of highest illumination.

High-Order – Most significant bits of a word. Typically, bit 8 through 15 of a 16-bit word.

Highpass Filter – Filter that passes only high frequencies.

High-Speed Shutter – A feature on video cameras and camcorders that allows detail enhancement of fast-moving objects by electronically dividing the CCD into imaging sections.

HIPPI (High Performance Parallel Interface) – A parallel data channel used in mainframe computers that supports data transfer rates of 100 Mbps.

Hiss – The most common audible noise component in audio recording, stemming from a combination of circuit and tape noise. Several noise reduction systems are available, such as Dolby™, DBX, DNR (Dynamic Noise Reduction), DNL (Dynamic Noise Limiter), to help alleviate such problems.

Hit – See Flash.

Hitachi – Proponent of the FUCE ATV scheme and enhanced versions of FUCE.

Hi-Vision – Japanese term for HDTV.

HLO-PAL (Half-Line Offset PAL) – An early NHK proposal for an ATV transmission scheme.

HLS – Hue, Luminance, and Saturation.

Hold Time – The time data must be stable following the completion of a write signal.

Holdback Tension – Tension applied by the supply turntable to hold the tape firmly against the heads.

Hole – a) In modeling a 3D world, it is often necessary to create polygons and solids which literally have holes in them. PictureMaker can make 2D holes in individual surfaces and drill 3D holes through convex portions of closed solids. **b)** A volume in the three-dimensional NTSC spectrum into which an auxiliary sub-channel can be placed with minimal impairment. Holes are found where horizontal, vertical, and temporal detail are simultaneously high. The most famous hole is the Fukinuki hole, but the most common hole is the one carrying the NTSC color subcarrier.

Home Directory – The directory into which IRIX places you each time you log in. It is specified in your login account; you own this directory and, typically, all its contents.

Horizontal (Hum) Bars – Relatively broad horizontal bars, alternately black and white, which extend over the entire picture. They may be stationary, or may move up or down. Sometimes referred to as a “venetian blind” effect. Caused by approximate 60-cycle interfering frequency, or one of its harmonic frequencies.

Horizontal Blanking – a) The entire time between the end of the active picture time of one line and the beginning of the active picture time of the next line. It extends from the start of front porch to the end of the back porch. **b)** The video synchronizing signal before and after each active television line that defines the border or black area at the left and right side of the display. In a CRT, it hides (blanks out) the electron beam’s retrace path as it returns from the right to the left of the display to begin scanning a new line.

Horizontal Blanking Interval (HBI) – That portion of the scanning line not carrying a picture. In NTSC, the HBI carries a synchronizing pulse and a color reference signal. Some scrambling and other systems add sound and/or data signals to the HBI. Some ATV schemes fill it with widescreen panel or detail enhancement signals. See also Blanking and Blanking Stuffing.

Horizontal Displacements – Describes a picture condition in which the scanning lines start at relatively different points during the horizontal scan. See Serrations and Jitter.

Horizontal Drive – A pulse at the horizontal sweep rate used in TV cameras. Its leading edge is coincident with the leading edge of the horizontal sync pulse and the trailing edge is coincident with the leading edge of the burst flag pulse.

Horizontal Interval – The time period between lines of active video. Also called Horizontal Blanking Interval.

Horizontal Lock – A subsystem in a video receiver/decoder which detects horizontal synchronizing pulses, compares them with the on-board video clock in the video system, and uses the resultant data to stabilize the incoming video by re-synching to the system clock. In the case of severe horizontal instability, a large FIFO memory may be required to buffer the rapid line changes before they are compared and re-synchronized.

Horizontal Resolution – a) Rating of the fine detail (definition) of a TV picture, measured in scan lines. The more lines, the higher the resolution and the better the picture. A standard VHS format VCR produces 240 lines of horizontal resolution, while over 400 lines are possible with S-VHS, S-VHS-C, and Hi-8 camcorders. **b)** Detail across the screen, usually specified as the maximum number of alternating white and black vertical lines (line of resolution) that can be individually perceived across the width of a picture, divided by the aspect ratio. This number is usually expressed as TV lines per picture height. The reason for dividing by the aspect ratio and expressing the result per picture height is to be able to easily compare horizontal and vertical resolution. Horizontal chroma resolution is measured between complementary colors (rather than black and white) but can vary in some systems (such as NTSC), depending on the colors chosen. Horizontal resolution in luminance and/or chrominance can vary in some systems between stationary (static resolution) and moving (dynamic resolution) pictures). It is usually directly related to bandwidth.

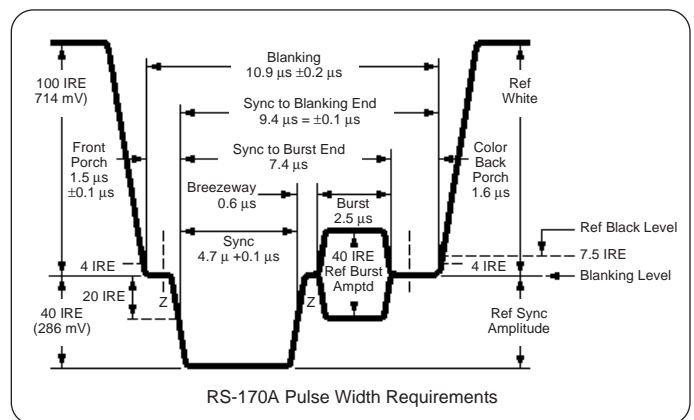
Horizontal Retrace – The return of the electron beam from the right to the left side of the raster after the scanning of one line.

Horizontal Scan Rate – The rate at which the screen’s scanning beam is swept from side to side. For (M) NTSC systems, this rate is 63.556 μ s, or 15.734 kHz.

Horizontal Sync – a) The –40 IRE pulse occurring at the beginning of each line. This pulse signals the picture monitor beam to go back to the left side of the screen and trace another horizontal line of picture information. **b)** The portion of the video signal that occurs between the end of one line of signal and the beginning of the next. A negative-going pulse from the blanking signal used to genlock (synchronize) equipment. It begins at the end of the front porch and ends at the beginning of the back porch.

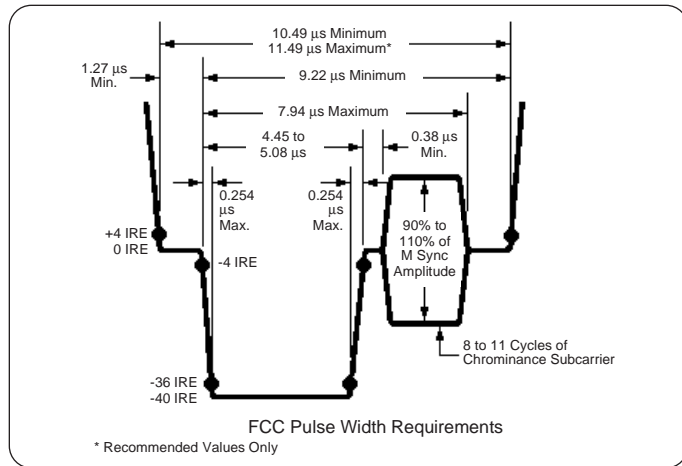
Horizontal Sync Pulse – See Horizontal Sync.

Horizontal Timing –



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Host – a) Any system connected to the network. **b)** A device where module(s) can be connected, for example: an IRD, a VCR, a PC.

Hostname – The name that uniquely identifies each host (system) on the network.

House Sync – a) The black burst signal used to synchronize all the devices in the studio or station. **b)** Sync generated within the studio and used as a reference for generating and/or timing other signals (i.e., sync gens).

HPF – High Pass Filter.

HQTV (High Quality TV) – Another term for HDTV.

HRS – High Resolution Sciences.

HSI – See Hue, Saturation and Intensity.

HSL – See Hue, Saturation, and Lightness.

HSM (Hierarchical Storage Management) – HSM systems transparently migrate files from disk to optical disk and/or magnetic tape that is usually robotically accessible. When files are accessed by a user, HSM systems transparently move the files back to disk.

HSV – See Hue, Saturation, and Value.

HSV Space – The three numbers are hue, saturation, and value. The solid is a cone. Also called HSI.

HSYNC – See Horizontal Synchronization or Sync.

Hue – a) A color wheel of basic pigments. All the hues of the rainbow encircle the cone's perimeter. **b)** The wavelength of the color which allows color to be distinguished such as red, blue, and green. Often used synonymously with the term tint. It is the dominant wavelength which distinguishes a color such as red, yellow, etc. Most commonly, video hue is influenced by a camera's white balance or scene lighting. Video color processors, such as the Video Equalizer, are the main tools used to adjust and correct hue problems. **c)** One of the three characteristics of television color. Hue is the actual color that appears on the screen. See Chroma and Luminance. **d)** Attribute of a visual sensation according to which an area appears to be similar to one of the perceived colors, red, yellow, green, and blue, or to a combination of two of them.

Hue, Saturation, and Intensity (HSI) – Color space system based on the values of Hue, Saturation, and Intensity. Intensity, analogous to luma, is the vertical axis of the polar system. The hue is the angle and the saturation is the distance out from the axis.

Hue, Saturation, and Lightness (HSL) – Nearly identical to HSI except Intensity is called Lightness. Both serve the same function.

Hue, Saturation, and Value (HSV) – Nearly identical to HSI and HSL except Intensity and Lightness are called Value. All three serve the same function.

Huffman Coding – Method of data compression that is independent of the data type, i.e., the data could represent an image, audio, or spread sheet. This compression scheme is used in JPEG and MPEG-2. Huffman Coding works by looking at the data stream that makes up the file to be compressed. Those data bytes that occur most often are assigned a small code to represent them (certainly smaller than the data bytes being represented). Data bytes that occur the next most often have a slightly larger code to represent them. This continues until all of the unique pieces of data are assigned unique code words. For a given character distribution, by assigning short codes to frequently occurring characters and longer codes to infrequently occurring characters, Huffman's minimum redundancy encoding minimizes the average number of bytes required to represent the characters in a text. Static Huffman encoding uses a fixed set of codes, based on a representative sample of data, for processing texts. Although encoding is achieved in a single pass, the data on which the compression is based may bear little resemblance to the actual text being compressed. Dynamic Huffman encoding, on the other hand, reads each text twice; once to determine the frequency distribution of the characters in the text and once to encode the data. The codes used for compression are computed on the basis of the statistics gathered during the first pass with compressed texts being prefixed by a copy of the Huffman encoding table for use with the decoding process. By using a single-pass technique, where each character is encoded on the basis of the preceding characters in a text, Gallager's adaptive Huffman encoding avoids many of the problems associated with either the static or dynamic method.

Hum – Undesirable coupling of 50 Hz (PAL) or 60 Hz (NTSC) power sine wave into other electrical signals.

Human Factors Guidelines – A set of standards and suggestions for making the working environment more comfortable and healthy.

HUT – Households Using Television.

HVS (Human Visual System) – Eyes and brain.

HVT (Horizontal, Vertical, and Temporal) – The three axes of the spatio-temporal spectrum.

Hybrid CD-ROM – A single disc containing files for both a Windows PC and a Macintosh. See CD-ROM.

Hybrid Coder – In the archetypal hybrid coder, an estimate of the next frame to be processed is formed from the current frame and the difference is then encoded by some purely intraframe mechanism. In recent years, the most attention has been paid to the motion compensated DCT coder where the estimate is formed by a two-dimensional warp of the previous frame and the difference is encoded using a block transform (the Discrete Cosine

Transform). This system is the basis for international standards for video telephony, is used for some HDTV demonstrations, and is the prototype from which MPEG was designed. Its utility has been demonstrated for video sequence, and the DCT concentrates the remaining energy into a small number of transform coefficients that can be quantized and compactly represented. The key feature of this coder is the presence of a complete decoder within it. The difference between the current frame as represented as the receiver and the incoming frame is processed. In the basic design, therefore, the receiver must track the transmitter precisely, the decoder at the receiver and the decoder at the transmitter must match. The system is sensitive to channel errors and does not permit random access. However, it is on the order of three to four times as efficient as one that uses no prediction. In practice, this coder is modified to suit the specific application. The standard telephony model uses a forced update of the decoded frame

so that channel errors do not propagate. When a participant enters the conversation late or alternates between image sources, residual errors die out and a clear image is obtained after a few frames. Similar techniques are used in versions of this coder being developed for direct satellite television broadcasting.

Hybrid Editing – Combining nonlinear edited video files with linear (deck-to-deck) segments of footage.

Hybrid Scalability – The combination of two or more types of scalability.

Hybrid Wavelet Transform – A combination of wavelet and transform algorithms within the same compression technology.

Hypercardioid – A directional pickup pattern where maximum discrimination occurs at more than 90 and less than 180 degrees off axis.

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I – Improved or Increased; also the in-phase component of the NTSC color subcarrier, authorized to have more than twice as much horizontal resolution as the Q, or quadrature component. Few TV sets have ever taken advantage of this increased chroma resolution, though there is renewed interest.

I, W, Q, B – An NTSC test signal used to check television broadcast equipment. It consists of an I signal followed by a white bar, then a Q signal and a black level on each line.

I/O – See Input/Output.

I/O Mapped I/O – I/O devices that are accessed by using instructions and control signals that differ from those of the memory devices in a system. Assigns I/O devices to a separate address space.

I/Q – In Phase/Quadrature Phase.

IB – In-Band.

IBA – Britain's Independent Broadcasting Authority, home of a great deal of ATV research.

IBE – Institution of Broadcast Engineers.

IBM – Member of the AEA ATV Task Force; also one of the first organizations to suggest sub-sampling as a technique for compatibility increasing detail.

IC (Integrated Circuit) – A small device incorporating the equivalent of hundreds or thousands of transistors, capacitors, resistors, and other components within a small, solid block.

IC – Interaction Channel.

ICC (International Color Consortium) – Established in 1993 by eight industry vendors for the purpose of creating, promoting, and encouraging the standardization and evolution of an open, vendor-neutral, cross-platform color management system architecture and components.

ICCE (International Conference on Consumer Electronics) – Sponsored by the Consumer Electronics Society of the IEEE and held annually in the Chicago area immediately following CES. ATV has become an increasingly important topic at ICCE.

Icon – A small picture that represents a stowed or closed file, directory, application, or IRIX process.

Iconoscope – A camera tube in which a high-velocity electron beam scans a photo-emissive mosaic which has electrical storage capability.

ICPM (Incidental Carrier Phase Modulation) – A transmission defect most noticeable as a cause of sync buzz.

IDE – Integrated Development Environment.

IDTV – See Improved Definition Television.

IEC (International Electrotechnical Commission) – The IEC and its affiliated International Organization for Standardization (ISO) are the two major global standards-making groups. They are concerned with establishing standards that promote interchange of products, agreement upon

methods of evaluation, and resolution of nonfunctional differences among national standards. They are structured as an international federation of the more than 50 national standards organizations. The USA is represented by the American National Standards Institute (ANSI).

IEEE – See International Electrical and Electronic Engineers.

IEEE P1394 (FireWire) – A low-cost digital interface organized by Apple Computer as a desktop LAN and developed by the IEEE P1394 Working Group. Can transport data at 100, 200, or 400 Mbps. Serial bus management provides overall configuration control of the serial bus in the form of optimizing arbitration timing, guarantee of adequate electrical power for all devices on the bus, assignment of which IEEE P1394 device is the cycle master, assignment of isochronous channel ID, and notification of errors. There are two types of IEEE P1394 data transfer: asynchronous and isochronous. Asynchronous transport is the traditional computer memory-mapped, load and store interface. Data requests are sent to a specific address and an acknowledgment is returned. In addition to an architecture that scales with silicon technology, IEEE P1394 features a unique isochronous data channel interface. Isochronous data channels provide guaranteed data transport at a pre-determined rate. This is especially important for time-critical multimedia data where just-in-time delivery eliminates the need for costly buffering.

IEEE Standard 511-1979 Video Signal Transmission Measurement of Linear Waveform Distortions – This IEEE standard gives a comprehensive technical discussion of linear waveform distortions.

IETF (Internet Engineering Task Force) – One of the task forces of the Internet Activities Board (IAB). The IETF is responsible for solving the short-term engineering needs of the Internet. It has over 40 working groups.

I-ETS – Interim European Telecommunications Standards.

IF (Intermediate Frequency) – The first state in converting a broadcast television signal into baseband video and audio.

IFFT – Inverse FFT.

I-Frame (Intra Frame) – One of the three types of frames that are used in MPEG-2 coded signals. The frame in an MPEG sequence, or GOP (Group of Pictures), that contains all the data to recreate a complete image. The original information is compressed using DCT.

IIM – Interactive Interface Module.

IIOB – Internet Inter-ORB Protocol.

IIT (Illinois Institute of Technology) – Home of most of the research into the SLSC ATV scheme.

Ikegami – Broadcast equipment manufacturer involved in a number of ATV schemes, including production of HDEP equipment to the SMPTE standard and schemes involving the use of a line doubler either before or after transmission.

Illegal Video – A color or colors that are not acceptable in a given color space.

Illuminance – Quotient of the luminous flux dF_v incident on an element of the surface containing the point by the area dA of the element. The illuminance also is commonly used in a qualitative or general sense to designate the act of illuminating or the state of being illuminated. Units of luminance are lux, foot candle.

IMA (Interactive Multimedia Association) – IMA has been active in the definition of the DVD through its DVD Special Interest Group (IMA DVD SIG). The IMA DVD SIG is a committee of DVD manufacturers working for interactive DVDs by establishing requirements and influencing specifications.

IMA ADPCM – The IMA has selected the 4:1 ADPCM audio compression scheme from Intel's DVI as the preferred compressed audio data type for interactive media platforms. Intel had offered the algorithm as an open standard to the IMA. The algorithm compresses 16-bit audio data at up to 44.1 kHz sampling into 4-bit ADPCM words.

Image – A two-dimensional (usually) picture. The picture may be represented in digital form or mathematically as an image is a set of planes in two dimensions. The two dimensions are the resolution in X and Y (columns, lines). The origin (0, 0) of the image is sometimes its lower left corner. There are four basic types of images: black and white or color, mask or no mask, Z plane or no Z plane, IPR information or no IPR information.

Image Buffer – See Frame Buffer.

Image Capture – The transducing of the information in a real image into the photographic or electronic medium. Normally in motion-reproducing systems, synchronous audio information is simultaneously transduced.

Image Compression – **a)** Process used to reduce the amount of memory required to store an image. See JPEG, MPEG, and Decimation.

b) Application of an appropriate transfer function to the image signal so as to limit dynamic range. **c)** Application of bandwidth limiting or bit rate reduction to an image signal in order to bring it within the limitations of a lower capacity channel.

Image Enhancement – **a)** Techniques for increasing apparent sharpness without increasing actual resolution. This usually takes the form of increasing the brightness change at edges. Since image enhancement has advanced continuously for nearly 50 years, ordinary NTSC pictures sometimes look better than the NTSC pictures derived from an HDEP source, particularly when these derived pictures are designed to be augmented by other signals in an ATV receiver. It is very difficult to enhance pictures for NTSC receivers and then unenhance them for receivers with augmentation.

b) Once the camera response has been made flat to 400 lines (by aperture correction), an additional correction is applied to increase the depth of modulation in the range of 250 to 300 lines (in an NTSC system), both vertically and horizontally. This additional correction, known as image enhancement, produces a correction signal with symmetrical overshoots around transitions in the picture. Image enhancement must be used very sparingly, if natural appearance is to be maintained.

Image File – A format for storing digital images. To save disk space, images are compressed in a binary file. The image format is contained in a file header which is read by all the programs. The header contains: the image name, the resolution, the type of image.

Image File Architecture – The Digital Information Exchange Task Force (SMPTE, IEEE, ATSC) on digital image architecture has as its goal the multi-disciplinary agreement upon and the definition of fully flexible, interoperable, scalable, and extensible systems. The objective is agreement on the structure of digital image files that will facilitate the exchange of such files across the technology interfaces. The scope includes both the rapid, unambiguous but concise identification of the file and its utilization, as well as the organization of the image data itself.

Image File Descriptor – The descriptor is a block of data that enhances the utility of the main data for the user. It may contain, in standardized format, data concerning production, ownership, access, previous processing, etc., relevant to the basic interpretation of the data.

Image File Header – The header is a very compact label that can be decoded by a universally accepted algorithm. Specific objectives are: identify encoding standard, specify length of the file, indicate whether a readable descriptor is included, permit random interception of data stream, and offer optional error protection.

Image File Header/Descriptor – A standard introductory identification directing access to a digital image file. The header provides a brief image file identification, universally decodable, indicating the format and length of the data block. The (optional) descriptor conveys additional information improving the usefulness of the data block to the user, such as cryptographic, priority, or additional error-protection information as well as source, time, authorship, ownership, restrictions on use, processing performed, etc.

Image File Motion-Picture Format – SMPTE Working Group H19.16 has proposed SMPTE Standard H19.161 defining the file format for the exchange of digital motion-picture information on a variety of media between computer-based systems. This flexible file format describes pixel-based (raster) images with attributes defined in the binary file descriptor, which identifies: generic file information, image information, data format, and image orientation information, motion-picture and television industry, specific information, user defined information. The draft assumes nonreal-time application, with formats for real-time to be considered as the developing technology permits.

Image File Video Index – Proposed descriptor developed by SMPTE Working Group P18.41. This proposed SMPTE recommended practice is intended to provide a method of coding video index information in which various picture and program-related source data can be carried in conjunction with the video signal. There are three classes of video index data based on type and use of the data. Class 1: Contains information that is required to know how to use the signal. Class 2: Contains heritage information for better usage of the signal. Class 3: Contains other information not required to know how to use the signal.

Image Generation – The creation of an image in the photographic or electronic medium from an image-concept (painted or generated by computer graphics, for example).

Image Innovator – An optional package which adds additional flags and menus to ADO 100, including Mosaics, Posterization, Solarization and Mask submenu, Target Defocus flag and Background menu, Border flags and Sides submenu.

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Image Pac – A multi-resolution image file format developed by Kodak as part of the Photo CD System.

Image Processing, Digital – Digital images are represented by a stream, currently of 8-bit or 10-bit values representing the luminance and chrominance information, or a stream of 8-bit or 10-bit values representing the R', G', and B' information. Image processing sometimes involves multiplication of each digital word by: its proportional contribution to the processed image, a vector to relocate the pixel, an algorithm to change overall image size. To control these processes, additional information may be carried in the alpha channel synchronized to the image. As an example of the process, if an 8-bit sample is multiplied by an 8-bit factor, the product becomes a 16-bit word. At some point, this may have to be rounded or truncated back to 8 bits for the next operation. This introduces slight discrepancies in the result which may be visible as lagged edges, color bleeding, etc. If successive truncations are performed during a sequence of image processing steps, the artifacts frequently become increasingly visible. Good practice calls for maintaining some or all of the “extra bits” throughout as much of the image processing as the facilities permit. Experience has shown that digital image processing provides the fewest distracting artifacts when the R', G', B' signals are first converted to the linear R, G, B. For complex image processing, and for critical results, the 8-bit encoding may be replaced by 10 bits (or more if that can be accommodated).

Image Quality Evaluation, Interval-Scaled – For comparisons of perceived image quality among significantly different systems, a requirement frequently encountered in electronic production, the technique of interval-scaling is recommended by most students of psycho-physics. Interval scaling gives some indication of the magnitude of preference for one system over another. Observers are asked to place a numerical value upon the perceived differences (either in total or with regard to a specified characteristic such as noise, resolution, color rendition, etc.).

Image Quality Evaluation, Ordinal-Scaled – For comparisons of perceived image quality resulting from a controlled variant within a single system, a requirement encountered when fine-tuning a system, the technique of ordinal-scaling is frequently employed. The ordinal-scale indicates that one image is preferred over another. Observers are asked to evaluate perceived image quality on an established scale, usually of five levels, from excellent to unacceptable. Correlations among isolated tests are sometimes uncertain.

Image Quality Evaluation, Ratio-Scaled – When images that differ significantly in creation, display, and content are being compared and interval-scaling becomes necessary, interpretation of the results become more and more complex as the number of observers is increased. Ratio-scaling provides a means for correlating multiple observations and multiple data sources. Observers are asked to assign a numerical value to perceived image quality (either in total or with regard to a specified characteristic such as noise, resolution, color rendition, etc.). They are also asked to identify numerical values for the best possible image, and the completely unacceptable image. Each is allowed to choose a numerical scale with which the observer feels most comfortable. The relationship between the value for the test image and the two extremes provides a useful ratio. Analyses involving comparisons among observers, comparisons with other

systems, correlation of results obtained over periods of time, etc., are made by normalizing each observer's scale (for example, best possible = 100, completely unacceptable = 0).

Image Quality, Objective – The evaluation obtained as a result of objective measurement of the quantitative image parameters (including tone scale, contrast, linearity, colorimetry, resolution, flicker, aliasing, motion artifacts, etc.)

Image Quality, Perceived – The evaluation obtained as a result of subjective judgment of a displayed image by a human observer.

Image Scaling – The full-screen video image must be reduced to fit into a graphics window (usually a fraction of the total computer display area), while at the same time maintaining a clear and complete image. To do this, it is important to remove or avoid visual artifacts and other “noise” such as degradation caused by pixel and line dropping, and interlacing problems from the scaling process. The challenges increase when dealing with moving images and the compression/decompression of large amounts of video data.

Image Stabilization – A camcorder feature which takes out minor picture shakiness, either optically or electronically.

Image Transform – First U.S. organization to modify television scanning for electronic cinematography, using 655 scanning lines per frame at 24 frames per second. Also created ImageVision.

ImageVision – An early HDEP scheme using 655 scanning lines per frame and 24 frames per second, with wide bandwidth video recording and a color subcarrier shifted to a higher frequency. Created and used by Image Transform for electronic cinematography.

Imaging Device – The part of the video camera or camcorder that converts light into electrical signals.

Immediate Addressing – In this mode of addressing, the operand contains the value to be operated on, and no address reference is required.

Impact Strength – A measure of the work done in breaking a test sample of tape or base film by subjecting it to a sudden stress.

Impairments – Defects introduced by an ATV scheme.

Impedance – **a)** The opposition of a device to current flow. A combination of resistance, inductive reactance, and capacitive reactance. When no capacitance or inductance is present, impedance is the same as resistance. **b)** A resistance to signal flow. Microphones and audio mixers are rated for impedance.

Impedance Matching – A video signal occupies a wide spectrum of frequencies, from nearly DC (0 Hz) to 6 MHz. If the output impedance of either the video source, cable, or input impedance of the receiving equipment are not properly matched, a series of problems may arise. Loss of high-frequency detail and color information as well as image instability, oscillations, snow, ghost images, and component heat-up may result. Proper connections and cable types provide correct impedances. See Load Resistance.

Improved Definition Television (IDTV) – IDTV is different from HDTV in that it uses the standard transmitted (M) NTSC or (B, D, G, H, I) PAL signal. IDTV improves the display of these signals by doing further processing of

the signal before displaying it. IDTV offers picture quality substantially improved over conventional receivers, for signals originated in standard 525-line or 625-line format, by processing that involves the use of field store and/or frame store (memory) techniques at the receiver. One example is the use of field or frame memory to implement de-interlacing at the receiver in order to reduce interline twitter compared to that of an interlaced display. IDTV techniques are implemented entirely at the receiver and involve no change to picture origination equipment and no change to emission standards.

Impulsive Noise – a) The signal-to-impulsive noise ratio is the ratio, in decibels, of the nominal amplitude of the luminance signal (100 IRE units) to the peak-to-peak amplitude of the noise. **b)** High level, short duration unwanted signals that tend to cause a sparkling effect in the picture and/or a percussive effect in the sound. Impulsive noise is often caused by motorized appliances and tools.

IMTC – International Multimedia Teleconferencing Consortium.

IN – Interactive Network.

INA – Interactive Network Adapter.

Incident Light – Light arriving at the surface of an object.

Incidental Carrier Phase Modulation (ICPM) – A distortion of the picture carrier phase caused by changes in either the chrominance or luminance video signal levels. This distortion is described in degrees using the following definition:

$$\text{ICPM} = \arctan(\text{quadrature amplitude/video amplitude})$$

The picture effects of ICPM will depend on the type of demodulation being used to recover the baseband signal from the transmitted signal. ICPM shows up in synchronously demodulated signals as differential phase and many other types of distortions, but the baseband signal is generally not as seriously affected when envelope detection is used. The effects of ICPM are therefore rarely seen in the picture in home receivers, which typically use envelope detection. However ICPM may manifest itself as an audio buzz at the home receiver. In the intercarrier sound system, the picture carrier is mixed with the FM sound carrier to form the 4.5 MHz sound IF. Audio rate phase modulation in the picture carrier can therefore be transferred into the audio system and heard as a buzzing noise. An unmodulated 5 to 10 stairstep signal or unmodulated ramp can be used to test for this distortion.

In-Circuit Emulator (ICE) – Debugging aid that connects to the system under test by plugging into the microprocessor's socket. This allows the ICE to gain full control over the system. Typical features include the ability to set breakpoints, single-step a program, examine and modify registers and memory, and divide memory and I/O between the system under test and the ICE system.

Increment – Adding the value “one” to the contents of a register or memory location.

Indeo – a) Intel's series of compressor and decompressor technologies for digital video, capable of producing software-only video playback. **b)** The Indeo is a video compression/playback technique from Intel. Just like CinePak, playback of Indeo compressed video does not require any special hardware. The Indeo algorithm, which used techniques like vector quantiza-

tion and run-length coding, is used by various other companies. A video file compressed with Indeo may be played on systems that support either Video for Windows or QuickTime. The new Indeo Video Interactive (IVI) software incorporates additional features to support interactive applications, and used a hybrid wavelet-based algorithm with bidirectional prediction. IVI may be played on systems that support Video for Windows, later also QuickTime, without dedicated hardware. Video encoded by IVI may be played at up to 640 x 480 pixels resolution and at up to 30 fps, depending on hardware configuration.

Indeo Video Interactive – Intel's latest compressor and decompressor for digital video, incorporating such special features as transparency, scalability, and local decode. See Indeo Video, Local Decode, Scalability, Transparency.

Indeo-C – The Indeo-C was a compression algorithm in the Personal Conferencing Specification (PCS) from the Personal Conferencing Work Group (PCWG), which was an industry group led by Intel. Due to lacking support by the industry, the PCWG dropped the PCS, and has now consolidated with International Multimedia Teleconferencing Consortium (IMTC) which supports ITU-T Red. H.320 videoconferencing. The Indeo-C algorithm did not use vector quantizing, as in Indeo, or a hybrid wavelet-based algorithm, as in Indeo Video Interactive, but used a transform coding called Fast Slant Transform (FST). An FST calculates frequency coefficients of picture blocks, like the DCT used in MPEG, but requires less computational power. Both intra-frame and inter-frame coding with motion estimation was applied in Indeo-C and finally, run-length and Huffman coding.

Independent Television – Television stations that are not affiliated with networks and that do not use the networks as a primary source of their programming.

Index Register – Contains address information used for indexed addressing.

Indexed Addressing – Mode in which the actual address is obtained by adding a displacement to a base address.

Indexing – Creation of a data index to speed up search and retrieval.

Indirect Addressing – Addressing a memory location that contains the address of data rather than the data itself.

Industrial/Professional – The grade of audio and video equipment that falls between consumer (low end) and broadcast quality. Industrial/professional equipment is characterized by its durability, serviceability, and more-professional end-result.

Inertia Idler – A rotating guide attached to a heavy flywheel to reduce the effect of varying supply reel friction on tape speed.

Information Services – Broad term used to describe full range of audio, video, and data transmission services that can be transmitted over the air or by cable.

Initialization – Setting a system to a known state.

Initialize – a) An auto sequence that causes a machine upon power up to arrive at a default condition. **b)** Record some data on a disk to allow its segments to be recognized by a controller.

In-Point – a) Beginning of an edit. **b)** The first frame that is recorded.

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Input – The terminals, jack, or receptacle provided for the introduction of an electrical signal or electric power into a device or system.

Input Converter – See Down Converter.

Input Port – Circuit that connects signals from external devices as inputs to the microprocessor system.

Input/Output (I/O) – a) Typically refers to sending information or data signals to and from devices. **b)** Lines or devices used to transfer information outside the system.

INRS – French acronym for the National Scientific Research Institute of the University of Quebec. INRS-Telecommunications shares facilities with Bell Northern Research, sort of Canada's Bell Labs, and has simulated both advanced encoders and ATV schemes on its computer simulation system.

Insert – a) The video that fills a key. Also used to describe the key itself. Insert for most keys is "self," that is, a key that is filled with the same video that cuts the hole. Ampex switchers also allow "matte" fill with an internally generated color and "bus fill" where any bus source may be selected to fill the key. **b)** An edit mode meaning to record a new video over a certain section of an existing video where the entry and exit are both defined and no new time code of control track is recorded.

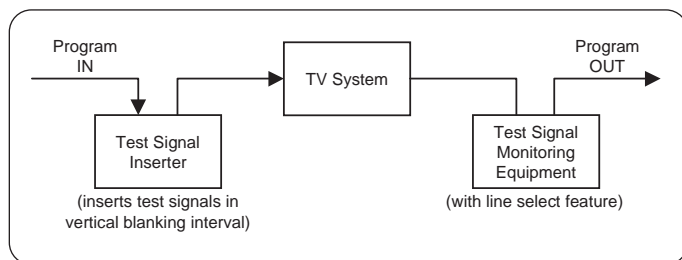
Insert Editing – The process of television post-production that combines audio and video signals on an existing control track.

Insertion Gain – In a CAV system, this refers to the overall amplitude of all three signals that make up the CAV signal and is measured as the peak-to-peak voltages of the three video signals (usually including sync on luminance levels).

Insertion Gain Measurement – Measurement of peak-to-peak amplitude values.

Insertion Loss – The decrease in level which occurs when a piece of equipment is inserted into a circuit so that the signal must flow through it.

In-Service (VITS or ITS Mode Testing) –



Instance – A clone of an object. If you modify the original, all the instance objects are likewise modified.

Instantaneous Value – The amplitude of a waveform at any one instant of time.

Institute of Electrical and Electronics Engineers – The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest technical professional society. Founded in 1884 by a handful of practitioners of the new electrical engineering discipline, today's Institute includes 46,000 students within a total membership of nearly 320,000 members who conduct

and participate in its activities in 150 countries. The men and women of the IEEE are the technical and scientific professionals making the revolutionary engineering advances which are reshaping our world today. And today's students are the future of the profession. The technical objectives of the IEEE focus on advancing the theory and practice of electrical, electronics, and computer engineering and computer science. To realize these objectives, the IEEE sponsors nearly 800 Student Branches worldwide, as well as scholarships and awareness programs, technical conferences, symposia, and local meetings; publishes nearly 25% of the world's technical papers in electrical, electronics, and computer engineering; and provides educational programs to keep its members' knowledge and expertise state-of-the-art. The main IEEE information system is in Piscataway, New Jersey, USA.

Instruction – Single command within a program. Instructions may be arithmetic or logical, may operate on registers, memory, or I/O devices, or may specify control operations. A sequence of instructions is a program.

Instruction Cycle – All of the machine states necessary to fully execute an instruction.

Instruction Decoder – Unit that interprets the program instructions into control signals for the rest of the system.

Instruction Register – Register inside the microprocessor that contains the opcode for the instruction being executed.

Instruction Set – Total group of instructions that can be executed by a given microprocessor. Must be supplied to the user to provide the basic information necessary to assemble a program.

Integrated Services Digital Networks – ISDN is a CCITT term for a relatively new telecommunications service package. ISDN is basically the telephone network turned all-digital end to end, using existing switches and wiring (for the most part) upgraded so that the basic call is a 64 kbps end-to-end channel, with bit manipulation as needed. Packet and maybe frame modes are thrown in for good measure, too, in some places. It's offered by local telephone companies, but most readily in Australia, France, Japan, and Singapore, with the UK and Germany somewhat behind, and USA availability rather spotty. A Basic Rate Interface (BRI) is two 64K bearer (B) channels and a single delta (D) channel. The B channels are used for voice or data, and the D channel is used for signaling and/or X.25 packet networking. This is the variety most likely to be found in residential service. Another flavor of ISDN is Primary Rate Interface (PRI). Inside the US, this consists of 24 channels, usually divided into 23 B channels and 1 D channel, and runs over the same physical interface as T1. Outside of the US then PRI has 31 user channels, usually divided into 30 B channels and 1 D channel. It is typically used for connections such as one between a PBX and a CO or IXC.

Intensity – Synonymous with luminance.

Interactive Videodisc – Interactive videodisc is another video-related technology, using an analog approach. It has been available since the early 1980s, and is supplied in the U.S. primarily by Pioneer, Sony, and IBM.

Intercarrier Sound – A method used to recover audio information in the NTSC system. Sound is separated from video by beating the sound carrier against the video carrier, producing a 4.5 MHz IF which contains the sound information.

Intercast – a) An Intel developed process which allows Web pages to be sent in the vertical blanking interval of a (M) NTSC video signal. The process is based on NABTS. **b)** Intericast technology allows television broadcasters to create new interactive content-text, graphics, video, or data around their existing programming and deliver this programming simultaneously with their TV signal to PCs equipped with Intericast technology. Intericast content is created with HTML which means that the interactive content of broadcast with the TV signal appears to the user as Web pages, exactly as if they were using the actual World Wide Web. These broadcast Web pages can also contain imbedded hyperlinks to related information on the actual Internet.

Interchange – Transfer of information between two processes.

Interchannel Timing Error – This error occurs in CAV three-wire or two-wire interconnect systems when a timing difference develops between signals being transmitted through the wires. The error manifests itself as distortions around vertical lines, edges, and in color distortions.

Inter-Coding – Compression that uses redundancy between successive pictures; also known as Temporal Coding.

Interconnect Format – See the Format definition.

Interconnect Standard – See the Standard definition.

Interface – Indicates a boundary between adjacent components, circuits, or systems that enables the devices to exchange information. Also used to describe the circuit that enables the microprocessor to communicate with a peripheral device.

Interference – a) In a signal transmission path, extraneous energy which tends to interfere with the reception of the desired signals. **b)** Defect of signal reproduction caused by a combination of two or more signals that must be separated, whether all are desired or not.

Inter-Frame Coding – a) Coding techniques which involve separating the signal into segments which have changed significantly from the previous frame and segments which have not changed. **b)** Data reduction based on coding the differences between a prediction of the data and the actual data. Motion compensated prediction is typically used, based on reference frames in the past and the future.

Interframe Compression – A form of compression in which the codec compresses the data within one frame relative to others. These relative frames are called delta frames. See Delta Frame, Key Frame. Compare Intraframe Compression.

Interframe Compression Algorithms – MPEG is one of many interframe algorithms that use certain key frames in a motion-prediction, interpolation system.

Interlace – a) Technique for increasing picture repetition rate without increasing base bandwidth by dividing a frame into sequential fields. When first introduced, it also had the characteristic of making the scanning structure much less visible. NTSC uses 2:1 interlace (two fields per frame). **b)** A process in which the picture is split into two fields by sending all the odd-numbered lines to field one and all the even-numbered lines to field two. This was necessary when there was not enough bandwidth to send a complete frame fast enough to create a non-flickering image.

Interlace Artifacts – Picture defects caused by interlace. These include twitter, line crawl, loss of resolution, and motion artifacts. In addition to causing artifacts, interlaced scanning reduces the self-sharpening effect of visible scanning lines and makes vertical image enhancement more difficult to perform.

Interlace Coefficient – A number describing the loss of vertical resolution due to interlace, in addition to any other loss. It is sometimes confused with the Kell factor.

Interlace Ratio – Alternate raster lines are scanned producing an odd field (odd-numbered lines) and an even field (even-numbered lines). An interlace of 1:1 implies vertically adjacent lines comprise the field.

Interlaced – Display system in which two interleaved fields are used to create one frame. The number of field lines is one-half of the number of frame lines. NTSC (M) systems have 262.5 lines per field. PAL (B, D, G, H, I) scan system have 312.5 lines per field. Each field is drawn on the screen consecutively – first one field, then the other. The field scanned first is called the odd field, the field scanned second is called the even field. The interlaced scanning system is used to prevent screen flicker. If frames were scanned on the screen without interlacing fields, the light level created by the first frame would decrease noticeably before the next frame could be scanned. Interlacing the fields allows the light level of the screen to be held more constant and thus prevent flicker.

Interlaced Carrier – A television subcarrier at a frequency that is an odd multiple of one half the line rate (for example, the NTSC color subcarrier). Such subcarriers fall onto a line in the spatio-temporal spectrum that is simultaneously high in vertical detail and in temporal detail, and is therefore not likely to be objectionably visible under normal viewing conditions.

Interlaced Scanning – A scanning process in which each adjacent line belongs to the alternate field. See Interlaced.

Interlaced Sequence – Sequence of pictures that can be either field picture or frame pictures.

Interlaced Video Mode – A mode in which the video raster is scanned over the face of the CRT by the electron gun, tracing alternate scan lines in successive refresh cycles. The quality of interlaced video is lower than sequentially scanned (non-interlaced) video because only half of the lines are refreshed at a time and interlaced video scans at a lower rate than non-interlaced video allowing for the manufacture of less expensive video monitors. NTSC video (standard TV) uses interlace video. A display system where the even scan lines are refreshed in one vertical cycle (field), and the odd scan lines are refreshed in another vertical cycle. The advantage is that the bandwidth is roughly half that required for a non-interlaced system of the same resolution. This results in less costly hardware. It also may make it possible to display a resolution that would otherwise be impossible on given hardware. The disadvantage of an interlaced system is flicker, especially when displaying objects that are only a single scan line high.

Interlacing – The process of drawing a frame by alternately drawing the rows of each field, creating the illusion that the image is being redrawn twice as often as it actually is. See Field.

Interleaver – The RS-protected transport packets are reshuffled byte by byte by the 12-channel interleaver. Due to this reshuffle, what were neighboring bytes are now separated by at least one protected transport packet:

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i.e., at least 204 bytes apart from each other. The purpose of this is the burst error control for defective data blocks.

Interleaving – A technique used with error correction that breaks up burst errors into many smaller errors.

Interline Flicker – See Twitter.

Intermodulation Distortion – Signal nonlinearity characterized by the appearance of frequencies in the output equal to the sums and differences of integral multiples of the component frequencies present in the input signal. Harmonics are usually not included as part of the intermodulation distortion.

Internal Drive – A drive that fits inside the workstation and connects to an internal port; it is never connected with a cable to a visible external port. An internal drive is occasionally referred to as a front-loading drive.

International Organization for Standardization (ISO) – A Geneva based organization for many of the national standardization bodies. Together with the International Electrotechnical Commission, IEC, ISO concentrates its efforts on harmonizing national standards all over the world. The results of these activities are published as ISO standards. Among them are, for instance, the metric system of units, international stationery sizes, all kinds of bolts and nuts, rules for technical drawings, electrical connectors, security regulations, computer protocols, file formats, bicycle components, ID cards, programming languages, International Standard Book Numbers (ISBN). Over 10,000 ISO standards have been published so far and you surely get in contact with a lot of things each day that conform to ISO standards you never heard of. By the way, ISO is not an acronym for the organization in any language. It's a wordplay based on the English/French initials and the Greek-derived prefix iso- meaning "same." Within ISO, ISO/IEC Joint Technical Committee 1 (JTC1) deals with information technology.

International Thomson – Name used by France's Thomson group for some recently acquired holdings outside of France. International Thomson is a strong proponent of progressive-scan ATV and has proposed two such schemes for NTSC countries, both of which would offer a 16:9 aspect ratio and 60 frames per second. One would have 900 scanning lines (864 active), matching the number of scanning lines in International Thomson's proposal for non-NTSC countries. The other would have 750 scanning lines (728 active), matching the digitization rates in the non-NTSC proposal.

Interoperability – The capability of providing useful and cost-effective interchange of electronic image, audio, and associated data among different signal formats, among different transmission media, among different applications, among different industries, among different performance levels.

Interpolation – In digital video, the creation of new pixels in the image by some method of mathematically manipulating the values of neighboring pixels. This is necessary when an image is digitally altered, such as when the image is expanded or compressed.

Interpolation (Line) – In television standards conversion, the technique for adjusting the number of lines in a 625-line television system to a 525-line system (and vice versa) without impairing the picture quality.

Interpolation (Movement) – A technique used in standards conversion to compensate for the degrading effects of different field frequencies on pictures which contain movement. Different approximate proportions of successive input fields are used in each output field.

Interpolation (Spatial) – When a digital image is repositioned or resized, different pixels are usually required from those in the original image. Simply replicating or removing pixels causes unwanted artifacts. With interpolation, the new pixels are calculated by making suitably weighted averages of adjacent pixels, giving more transparent results. The quality depends on the techniques used and the area of original picture, expressed as a number of pixels or points. Compare with Interpolation (Temporal).

Interpolation (Temporal) – Interpolation between the same point in space on successive frames. It can be used to provide motion smoothing and is extensively used in standard converters to reduce the defects caused by the 50/60 Hz field rate difference. This technique can also be adapted to create frame averaging for special effects.

Interrupt – Involves suspension of the normal program that the microprocessor is executing in order to handle a sudden request for service (interrupt). The processor then jumps from the program it was executing to the interrupt service routine. When the interrupt service routine is completed, control returns to the interrupted program.

Interrupt Mask – Register that has one bit to control each interrupt. Used to selectively disable specific interrupts.

Interrupt Service Routine – Program that is executed when an interrupt occurs.

Interrupt Vectoring – Providing a device ID number or an actual branching address in response to the interrupt acknowledge signal. Allows each interrupt to automatically be serviced by a different routine.

Interval Timer – Programmable device used to perform timing, counting, or delay functions. Usually treated as a peripheral.

Intra-Coded Pictures (I-Pictures or I-Frames) – Pictures that are coded by using information present only in the picture itself and without depending on information from other pictures. I-pictures provide a mechanism for random access into the compressed video data. I-pictures employ transform coding of the pixel blocks and provide only moderate compression.

Intra-Coding – Compression that works entirely within one picture: also known as Spatial Coding.

Intra-Frame Coding – Video coding within a frame of a video signal.

Intraframe Compression – A form of compression in which the codec compresses the data within one frame relative only to itself. Key frames are compressed with intraframe compression because they must reconstruct an entire image without reference to other frames. See Delta Frame, Key Frame. Compare Interframe Compression.

Intraframe Compression Algorithm – A still image or photo video compression standard. JPEG compression ratios vary from 20:1 to 40:1 with a lossless ratio of 5:1. JPEG is a symmetrical standard inasmuch as it takes the same amount of time to decompress as it does to compress video. JPEG works best with smooth transitions and little motion.

Intrinsic Coercive Force – The magnetizing field strength needed to reduce flux density from saturation to zero.

Intrinsic Coercivity – The maximum value of the intrinsic coercive force. The intrinsic coercivity is a basic magnetic parameter for the material and requires complete saturation of the sample for its measurement as does the saturation flux density.

Intrinsic Flux – In a uniformly magnetized sample of magnetic material, the product of the intrinsic flux density and the cross-sectional area.

Intrinsic Flux Density – In a sample of magnetic material for a given value of the magnetizing field strength, the excess of the normal flux density over the flux density in vacuum.

Intrinsic Hysteresis Loop – Graph of magnetic flux (B) plotted against the magnetizing force (H) producing it. The value of B when H has dropped to zero is the residual magnetism, and the reverse force needed to reduce B to zero is known as the coercivity. Units used are: Magnetizing Force (H) in oersteds and Flux Density (B) in gauss. Coercivity is measured in oersteds.

INTSC (Improved NTSC) – A term rarely used to describe ATV schemes incorporating any combination of techniques.

Techniques to Improve NTSC Compatibility

A. Monochrome and Color

1. Sampling, Aperture, and Interlace Problems
 - Progressive
 - High Line Rate Display
 - Progressive Camera and Prefiltering
 - High Line Rate Camera and Prefiltering
 - Image Enhancement at the Camera
 - Image Enhancement at the Receiver
2. Transmission Problems
 - Ghost Elimination
 - Noise Reduction
 - Improved Filter Design and Adjustment
3. Changing Equipment Problems
 - Gamma Correction
 - Adaptive Emphasis
 - Rigid Adherence to Standards

B. Color Problems

1. Improved Decoder Filtering
2. Prefiltering
3. Full Detail Decoders
4. Luminance Detail Derived from Pre-Encoded Chroma

Invar – An expensive, brittle metal used to make the shadow mask in a direct-view color picture tube. Incorporating it allows higher picture contrast levels from the tube without incurring long-term damage to the shadow mask itself. It allows the set manufacturer to offer higher contrast levels. Since the phosphors in the tube reach the point of blooming well before the need for the Invar mask, anyone properly setting the contrast level for no blooming in the picture won't ever need the features of the Invar mask. The high contrast levels permitted by the Invar mask will eventually burn the phosphors.

Inverse Nyquist Filter – A filter that is a complement of the filter used to reduce interference in the IF section of a television set.

Inverted Key – We think of a normal key as, for example, letters superimposed over a background. When this key is inverted, the background appears inside the key; it appears we are looking through the cut-out key and seeing the background. The key insert video appears outside the key.

IO (Image Orthicon) – The picture-forming tube in a TV camera.

Ion – A charged atom, usually an atom of residual gas in an electron tube.

Ion Spot – A spot on the fluorescent surface of a cathode ray tube, which is somewhat darker than the surrounding area because of bombardment by negative ions which reduce the phosphor sensitivity.

Ion Trap – An arrangement of magnetic fields and apertures which will allow an electron beam to pass through but will obstruct the passage of ions.

IOR – Interoperable Object Reference.

IP (Internet Protocol) – The network layer protocol for the Internet protocol suite.

IP Address – The number that uniquely identifies each host (system) on the network.

I-Picture (Intra-Coded Picture) – One of three types of digital pictures in an MPEG data stream. An I-picture is not predictive and is essentially a snapshot picture. This type of picture generally has the most data of any of the picture types. A picture coded using information only from itself. For that reason, an I-picture can be decoded separately.

IPCP – Internet Protocol Control Protocol.

IPS – Inches Per Second.

IQ – In-Phase/Quadrature Components.

IQTV (Improved Quality Television) – A rarely used term for IDTV and INTSC.

IRD (Integrated Receiver Decoder) – **a)** A combined RF receiver and MPEG decoder that is used to adapt a TV set to digital transmissions. **b)** An IRD with digital interface has the ability to decode Partial Transport Streams (TS) received from a digital interface connected to digital bitstream storage device such as a digital VCR, in addition to providing the functionality of a Baseline IRD.

IrDA – Infrared Data Association.

IRE (Institute of Radio Engineers) – The composite analog television signal's amplitude can be described in volts or IRE units with 140 IRE representing a full amplitude composite analog signal. The 0 IRE point is at blanking level, with sync tip at -40 IRE and white extending to +100 IRE. In the studio, the composite analog video signal is typically 1 volt in amplitude. Thus in the studio, 1 IRE is equal to 1/140 of a volt or 7.14 mV. IRE stands for Institute of Radio Engineers, the organization which defined the unit.

IRE Roll-Off – The IRE standard oscilloscope frequency response characteristic for measurement of level. This characteristic is such that at 2 MHz the response is approximately 3.5 dB below that in the flat (low frequency) portion of the spectrum, and cuts off slowly.

Video Terms and Acronyms

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IRE Scale – An oscilloscope scale in keeping with IRE Standard 50, IRE 23.S1, and the recommendations of the Joint Committee of TV Broadcasters and Manufacturers for Coordination of Video Levels.

IRE Units – a) A linear scale for measuring the relative amplitudes of the various components of a television signal. Reference white is assigned a value of 100, blanking a value of 0. **b)** The values for NTSC composite and for SMPTE 240M are shown in the following table. One IRE unit corresponds to 7-1/7 mV in CCIR System M/NTSC and to 7.0 mV in all other systems. Measurement procedure developed by the Institute of Radio Engineers, the predecessor to the IEEE.

	IRE Units	RF	Video Baseband	
		Modulation ⁽¹⁾	M/NTSC	SMPTE 24
		%	Millivolts ⁽²⁾	
Zero Carrier	120	0	–	–
White Clip⁽³⁾	105-110	6.2-9.4	–	–
Reference White⁽⁴⁾	100	12.5	715 ⁽⁵⁾	700
Reference Black⁽⁶⁾	7.5	70.3	54	0
Blanking	0	75	0	0
Sync Peaks (Max Carrier)	–40	100	–286 (5)	±350

(1) From Benson: Television Engineering Handbook.

(2) Video waveform specified in ANSI/EIA/TIA 25D-C-1989. It becomes an operational requirement to map the scene luminance within the video waveform specifications so that subjectively acceptable image recreation can be obtained on display.

(3) Typical (arbitrary) values to limit overload of analog signals, or to define maximum digital equivalent.

(4) Under scene illumination, the light from a nonselective diffuse reflector (white card) whose reflectance factor is 90% compared to a “perfect reflector” (prepared magnesium oxide = 98%).

(5) Frequently indicated as +700 and –300, respectively.

(6) Specified for NTSC in ANSI/EIA/TIA 250-C-1989. Many other systems place reference black at blanking level.

Iredale, Richard – Creator of the HD-NTSC ATV scheme and the HD-PRO HDEP scheme.

IRIG (Inter-Range Instrumentation Group) – Has recently been renamed “Range Control Council.”

IRIS – Any graphics workstation manufactured by Silicon Graphics, Inc.

Iris – The video camera’s lens opening which regulates the amount of light entering a camera.

IRIX – Silicon Graphics, Inc.’s version of the UNIX operating system. See also System Software.

Iron Oxide/Gamma Ferric Oxide – The most popular oxide particle used as a magnetic recording medium produced from an oxide of pure iron.

IRT (Institut für Rundfunktechnik) – IRT is the research and development branch of the public broadcasters in Germany (the ARD and ZDF), Austria (the ORF) and in Switzerland (the SRG). Situated in Munich, Germany, the IRT participates in both national and international research projects, and is highly involved in broadcasting system development. Specifically, IRT has participated in the development of digital audio bit rate

reduction, and is one of the three licensors of MPEG Layer II of which the IRT conducts conformance tests.

IS – International Standard.

IS&T – Society for Imaging Science and Technology.

ISA (Industry Standard Architecture) – Originally designed around the 16-bit 286 microprocessor and called the AT bus, the ISA bus has 24 address and 16 data lines, sufficient to handle 16 megabyte memory I/O addresses. The ISA bus is limited to a slow 8 MHz clock speed and for this reason, faster peripherals and memory left the ISA bus behind soon after its development. Unlike the earlier 8-bit PC/XT bus, the ISA bus includes two connectors. In addition to the single, 62-pin, 8-bit PC/XT bus connector, the ISA bus includes a second connector with four additional address and eight additional data lines, interrupt, and DMA control lines. Although IBM documented every pin on the ISA bus, they never published strict timing specifications to signals on the bus. As a result, ISA bus system developers designing products for many platforms had to guess at timing. Problems developed as a result of holding the ISA bus to 8 MHz for backward compatibility. Some anxious manufacturers pushed the system speed causing products with marginal operations characteristics, especially when extra memory was added to high-speed PCs. Since the IEEE ISA standard of 1987, the bus signals have remained unchanged. In 1993, Intel and Microsoft announced a joint development, Plug and Play ISA, a method for making expansion boards work with the ISA bus, eliminating the need for DIP switch settings, jumpers, interrupts, DMA channels, ports, and ROM ranges. The Plug and Play card tells the host computer what resources it requires. This requires a large software-based isolation protocol which keeps an expansion board switched off until it can be addressed, allowing one card to be polled at a time because slot-specific-address enable signals for expansion cards are not part of the ISA specification. In 1987, the ISA bus made way for the IBM PS/2 “clone-killer” computer “Micro Channel” bus however, the clone makers initially ignored the PS/2 and Micro Channel.

ISA Transfer – One of the advantages of an ISA transfer is that it allows the user to process images as they go through the processor. However, its utility is limited by its low bandwidth. Even under ideal conditions, the ISA transfer requires three to five BCLK cycles at 8 MHz to transfer a single pixel. This represents a severe system throughput penalty; a large percentage of the available (and already limited) bandwidth is consumed by the transfer.

ISDB (Integrated Services Digital Broadcasting) – An NHK-suggested broadcast equivalent to ISDN.

ISDN – See Integrated Services Digital Network.

ISI – Inter Symbol Interference.

ISO – See International Organization for Standardization.

ISO Reel – Multiple reels of tape of the same subject recorded simultaneously from different cameras on different VTRs.

Isokey – See External Key.

Isolated Key – A key where the “hole cutting” or key video is different from the “key filling” or insert video. This is most commonly used with character generators that provide these two outputs, and allows the char-

acter generator to create a key border that is wider and cleaner than internally bordered keys. Such signals may also come from a color camera that provides its own keying output or even a monochrome camera looking at an art card. An isolated key is always a luminance key, although composite chroma keys may be done with an isolated key source, ignoring the isolated input. AVC series switchers can defeat isolated inputs to standard type keys by turning key borders on. Also referred to as a Processed External Key.

Isoparameters – The curves along a surface resulting from setting u or v to a constant value.

ISP – Internet Service Provider.

ISVR Pro – See Smart Video Recorder Pro.

IT – Information Technology.

Iterative – Procedure or process that repeatedly executes a series of operations until some condition is satisfied. Usually implemented by a loop in a program.

ITFS – Instructional Television Fixed Service.

ITS (Insertion Test Signal) – A test signal which is inserted in one line of the vertical interval to facilitate in-service testing.

ITSTC – Information Technology Steering Committee.

ITTF – Information Technology Task Force.

ITU (International Telecommunications Union) – The United Nations specialized agency dealing with telecommunications. At present, there are 164 member countries. One of its bodies is the International Telegraph and Telephone Consultative Committee, CCITT. A Plenary Assembly of the CCITT, which takes place every few years, draws up a list of “Questions” about possible improvements in international electronic communication. In Study Groups, experts from different countries develop “Recommendations” which are published after they have been adopted. Especially relevant to computing are the V series of recommendations on modems (e.g. V.32, V.42), the X series on data networks and OSI (e.g., X.25, X.400), the I and Q series that define ISDN, the Z series that defines specification and programming languages (SDL, CHILL), the T series on text communication

(teletext, fax, videotext, ODA), and the H series on digital sound and video encoding.

ITU-R (International Telecommunication Union, Radiocommunication Sector) – Replaces the CCIR.

ITU-R.601 – See ITU-R BT.601.2.

ITU-R.624 – ITU standard that defines PAL, NTSC, and SECAM.

ITU-R BT.601-2 – a) Standard developed by the International Radio Consultative Committee for the digitization of color video signals. ITU-R BT.601 deals with the conversion from component RGB to YCbCr, the digital filters used for limiting the bandwidth, the sample rate (defined as 13.5 MHz), and the horizontal resolution (720 active samples).

b) International standard for component digital television from which was derived SMPTE 125M (was RP-125) and EBU 3246E standards. CCIR defines the sampling systems, matrix values, and filter characteristics for both Y, B-Y, R-Y and RGB component digital television.

ITU-R BT.653 – Standard that defines teletext systems used around the world.

ITU-R BT.656 – The physical parallel and serial interconnect scheme for ITU-R BT.601-2. ITU-R BT.656 defines the parallel connector pinouts as well as the blanking, sync, and multiplexing schemes used in both parallel and serial interfaces.

ITU-R BT.709-3 – Part II of the recommendation describes the unique HD-CIF standard of 1080 lines by 1920 samples/line interlace and progressively scanned with an aspect ratio of 16:9 at both 50 Hz and 60 Hz field and frame rates for high definition program production and exchange.

ITU-T – International Telecommunication Union, Telecommunication Standardization Sector.

ITVA – International Television Association.

IVUE – A file format associated with FITS technology that enables images to be opened and displayed in seconds by showing only as much data on the screen as is implied by the screen size and zoom factor.

IWU – Inter-Working Unit.

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▶ J

J.41 – A recommendation from the ITU-T covering high-quality coding of audio material at 384 kbit/s. In the same family, we find the J.42, the J.43, and the J.44 recommendations that define the coding of analog “medium quality” sound at 384 kbit/s, “high quality” sound at 320 kbit/s, and “medium quality” sound at 320 kbit/s, respectively.

J.81 – This ITU-T recommendation is identical to the ETSI standard ETS 300 174 for video broadcast transmission at 34 Mbit/s.

Jack – Receptacle for a plug connector leading to the input or output circuit of a tape recorder or other piece of equipment. A jack matches a specific plug.

Jaggies – a) Slang for the stair-step aliasing that appears on diagonal lines. Caused by insufficient filtering, violation of the Nyquist Theory, and/or poor interpolation. **b)** A term for the jagged visual appearance of lines and shapes in raster pictures that results from producing graphics on a grid format. This effect can be reduced by increasing the sample rate in scan conversion.

Jam Sync – Process of locking a time-code generator to existing recorded time code on a tape in order to recreate or extend the time code. This may be necessary because, beyond a given point on tape, time code may be non-existent or of poor quality.

Japan Broadcasting Corporation – See NHK.

JBIG – See Joint Bi-Level Image Experts Group.

JBOD (Just a Bunch of Disks) – A collection of optical/magnetic disks used for storing data.

JCIC (Joint Committee for Inter-Society Coordination) – A group comprised of the EIA, the IEEE, the NAB, the NCTA, and the SMPTE. The JCIC created the ATSC in 1982 to handle all of the new advances in TV, including HDTV. The ATSC has since grown to 52 member and observer organizations.

JEC – Joint Engineering Committee of EIA and NCTA.

Jitter – a) An undesirable random signal variation with respect to time. A tendency toward lack of synchronization of the picture. It may refer to individual lines in the picture or to the entire field of view. **b)** A rapid, small shift in image position characteristic of film projection. Projection jitter can reduce the apparent resolution of film.

Jitter Amplitude – The variation in phase of the bit rate clock expressed as a percent of the bit period.

Jitter Rate – The rate of change of the jitter amplitude expressed as a frequency in Hertz.

JND (Just Noticeable Difference) – A measure of the minimum perceptible change in quality. A one JND change is accurately detected 75 percent of the time; a three JND change is accurately detected 99 percent of the time. There is a large number of JNDs of difference between NTSC as it is now received in U.S. homes and HDEP. This difference decreases in ATV systems in a hierarchical order. Some feel that a large number of JNDs will be necessary for consumers to purchase new TV sets.

Jog/Shuttle Wheel – A dial on many video decks, VCRs and editing control units that controls jog and shuttle functions.

Jogging – Single-frame forward or backward movement of video tape.

Joint Bi-Level Image Experts Group (JBIG) – A lossless bi-level (black and white) image compression technique. JBIG is intended to replace G3 fax algorithms. The JBIG technique can be used on either gray-scale or color images. Some of the applied techniques have a strong resemblance with the JPEG standard. Commercially available implementations of JBIT have been scarce, but some find use in remote printing of newspapers.

Joint Photographic Expert Group (JPEG) – Compression technique for still images, such as photographs, a single video frame, etc. JPEG can be used to compress motion video. However, it is not as efficient as MPEG which has been optimized for motion video compression applications.

Jot – The text editor that comes as a standard utility on every IRIS.

Joystick – Affecting control over X, Y, and Z parameters. Typical uses are switcher pattern positioner, ADO positioner/controller, ACE switcher preview controller. See Positioner.

JPEG – See Joint Photographic Experts Group.

JPEG-1 – ISO/IEC DIS 10918-1 begins with a digital image in the format Y, CB, CR (such as defined in CCIR 601-2) and provides several levels of compression. Predictive coding and transforms are employed, with the higher compression ratios selectively recognizing the decrease in human visual acuity with increasing spatial frequencies. It is optimized for about 15:1 compression. As increased data storage and increased processing capabilities are becoming available, there is exploration of adapting JPEG-1 for application to successive frames in real time; i.e., full-motion JPEG.

JPEG-2 – ISO/IEC CD 11172 describes procedures for compliance testing in applications of JPEG-1.

JPG – Filename extension for graphic image files stored using JPEG compression.

JTC – Joint Technical Committee.

Judder – a) Jerkiness of motion associated with presentation rates below the fusion frequency. **b)** A temporal artifact associated with moving images when the image is sampled at one frame rate and converted to a different frame rate for display. As a result, motion vectors in the display may appear to represent discontinuously varying velocities. The subjective effect of the artifact becomes more obvious when the frame-rate conversions are made by simple deletions or repetitions of selected frames (or fields). It may become less obvious when interpolated frames (or fields) are generated by employing predictive algorithms.

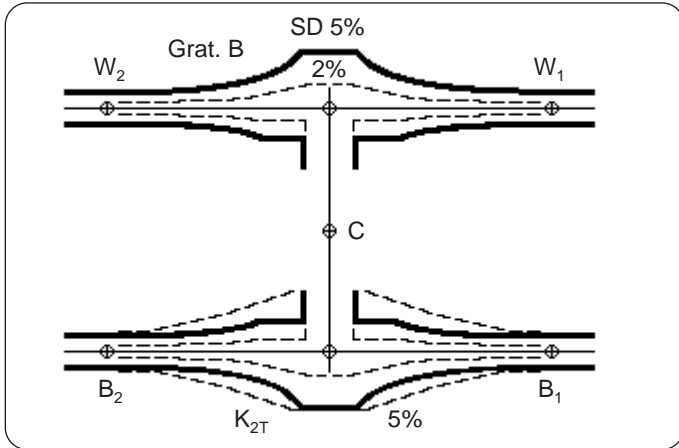
Jump – Instruction that results in a change of sequence.

Jump Cut – A mismatched edit that creates a visual disturbance when replayed. Usually occurs when cutting between two images which share an identical subject but place the subject at different positions in the frame.

► **K**

K – Symbol for 1000 (10^3). When referring to bits or words, $K = 1024$ (2^{10}).

K Factor Ratings – The K Factor rating system maps linear distortions of 2T pulses and line bars onto subjectively determined scales of picture quality. The various distortions are weighted in terms of impairment to the picture.



The usual K Factor measurements are $K_{\text{pulse/bar}}$, K_{2T} or K_{pulse} (2T pulse response), K_{bar} and sometimes $K_{60\text{Hz}}$. The overall K Factor rating is the largest value obtained from all of these measurements. Special graticules can be used to obtain the K Factor number or it can be calculated from the appropriate formula. All types of linear distortions affect the K Factor rating. Picture effects may include any of the short time, line time, field time, and long time picture distortions. Any signal containing the 2T pulse and an 18 μsec bar can be used to measure $K_{\text{pulse/bar}}$, K_{2T} (K_{pulse}), or K_{bar} . A field rate square wave must be used to measure $K_{60\text{Hz}}$. The FCC composite test signal contains these signal components. See the discussion on Pulse to Bar Ratios.

K_{2T} or K-2T – K_{2T} is a weighted function of the amplitude and time of the distortions occurring before and after the 2T pulse. In practice, a graticule is almost always used to quantify this distortion. Different countries and standards use slightly different amplitude weighting factors. The figure below shows a typical waveform monitor K Factor graticule display. The outer dotted lines at the bottom of the graticule indicate 5% K_{2T} limits. See the discussion on Pulse to Bar Ratios.

$K_{60\text{Hz}}$ – A field-rate square wave is used to measure this parameter. Locate the center of the field bar time, normalize the point to 100%, and measure the maximum amplitude deviation for each half. Ignore the first and last 2.5% (about 200 μsec). The largest of the two tilt measurements divided by two is the $K_{60\text{Hz}}$ rating.

Karaoke – A special DVD format that allows for certain special features. The audio portion of this format is distinctive in that it is intended for “sing along” formats and may include audio tracks for “guide vocals,” “guide melody,” “chorus,” and the main Karaoke left and right channels. The audio track for Karaoke in DVD-video is defined to be applicable for multi-

channel setup with five channels maximum. When this vocal part is recorded mainly in track 4 and 5 except the main two channels, users can enjoy many different playback modes by Karaoke-type DVD players equipped with various audio on/off switches.

Kb (Kilobyte) – A standard unit for measuring the information storage capacity of disks and memory (RAM and ROM); 1024 bytes make one kilobyte.

K_{bar} – A line bar (18 μsecs) is used to measure K_{bar} . Locate the center of the bar time, normalize that point to 100%, and measure the maximum amplitude deviation for each half. Ignore the first and last 2.5% (0.45 μsec) of the bar. The largest of the two is the K_{bar} rating.

Keeper – Term used to indicate the effect, edit was good enough to keep, but could possibly be improved on; however, the effect or edit should be stored “as is” in case it cannot be improved upon.

Kell Effect – Vertical resolution of a scanned image subjectively evaluated is consistently shown to be less than the geometrically-predicted resolution. Observations are usually stated in terms of the ratio of perceived television lines to active lines present in the display. From the time that R. Kell published his studies (conducted on a progressive scanned image), there have been numerous numerical values and substantiating theories proposed for this effect. The range of results suggests that many details of the experiments influence the result and make defining a single “Kell Factor” impossible. Reported experimental results range at least between 0.5 and 0.9. In an otherwise comparable display, the “ratio” is lower for interlaced scanning than for progressive scanning.

Kell Factor – A number describing the loss of vertical resolution from that expected for the number of active scanning lines. Named for Ray Kell, a researcher at RCA Laboratories. Many researchers have come up with different Kell factors for progressively scanned television systems. These differences are based on such factors as aperture shape, image content, and measurement technique. A generally accepted figure for the Kell factor is around 0.68, which, multiplied by the 484 active NTSC scanning lines, yields a vertical resolution of 330 lines, matched by NTSC’s 330 lines of horizontal resolution per picture height (see Square Pixels). It is important to note that most studies of the Kell factor measure resolution reduction in a progressive scanning system. Interlaced scanning systems suffer from both a Kell factor and an interlace coefficient.

Kelvin – A system or scale used for measuring temperature. Absolute zero is 0° Kelvin or -273°C . The “color” of white light is expressed in terms of degrees Kelvin, the color of light emitted when an ideal object is heated to a particular temperature.

Kernel – Minimum circuitry required to allow the microprocessor to function. Usually consists of the microprocessor, clock circuit, interrupt and DMA control lines, and power supply.

Key – a) A signal that can electronically “cut a hole” in the video picture to allow for insertion of other elements such as text or a smaller video picture. **b)** A video that has been overlaid on top of another video. Keys may

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► Glossary

be either determined by the luminance or brightness of the key video, or determined by the chroma or hue of the key video. **c)** A push-button.

Key Channel – See Alpha Channel.

Key Fill – Line key effects, the video signal which is said to “fill the hole” cut in background video by the key source.

Key Frame – A frame containing all the data representing an image, rather than just the data that has changed since the last frame. The first frame of every video file is a key frame; in addition, they occur throughout the file to refresh image quality and permit certain operations, such as random user access. Compare Delta Frame.

Key Gain – An adjustment for keys that determines the sharpness of the key edges. As key gain is reduced, keys become softer at the edges and may be adjusted to be more transparent.

Key Insert – The video that fills a key.

Key Invert – **a)** A luminance key mode which inverts the polarity of the key source to allow dark areas of the source video to cut holes in background instead of bright areas. **b)** A chroma key mode which inverts the foreground and background positions.

Key Light – The term used to describe a subject's main source of illumination. When shooting outdoors, the key light is usually the sun.

Key Mask – A key mode which allows use of independent key mask generators to create a pattern to prevent some undesirable portions of the key source from cutting a hole in the background. This is also possible using externally generated masks on the Vista.

Key Matrix – The electronic crosspoints which switch and route key signals and key insert signals to appropriate key processing electronics. On Ampex switchers, these matrices are controlled by keypads and keyer insert selector push-button controls and form the Phantom matrix portion of the switcher.

Key Memory – An AVC series feature that allows a key to be fully adjusted as soon as it is selected. This is accomplished by a “store” button on the key adjust panel that may be pressed when an operator is satisfied with the adjustment of a key. From that point on, whenever that key is selected, regardless of which keyer it is on, all adjustments and features of that key are automatically recalled.

Key Signal – A hole cutting signal.

Key Source – A hole cutter. The signal which is said to “cut a hole” in the background scene for a key effect. In actuality, this signal controls a video mixer which switches between the background scene and the fill video; thus, the key source determines the shape of the key effect.

Key Type – There are three key types on Ampex switchers; luminance keys, RGB chroma keys, and composite chroma keys.

Keyboard – **a)** Group of push-buttons used for inputting information to a system. **b)** The human interface portion of a computer, typewriter with alpha numeric keys, or push-buttons.

Keyer – The electronics and panel controls that create keys. There are many types of keyers, some limited to titles only, and some capable of any type of key. All Ampex keyers are full capability.

Keyframe – **a)** Keyframes are important frames that are guides in creating frames that occur between the keyframes. **b)** A specific manipulation or positioning of the image. An effect is composed of one or more keyframes.

Keyframe Duration – The length of the keyframe; the time from keyframe to the start of the next.

Keying – The process of replacing part of one television image with video from another image; that is chroma keying and insert keying.

Keycode – A barcode on the edge of motion picture film which allows the film edge numbers to be electronically read and inserted into an edit list. Very useful for generating a negative cut list from a video off-line EDL.

Key-Length-Value (KLV) – The grouping of information concerning a single metadata element that combines three pieces of information: its UL Data Key, the Length of its instantiation Value in the next field, its instantiated Value in the allowed format.

Keypad – The numbered push-buttons used to enter numerical data, i.e., pattern numbers, transition rates, key source numbers, etc.

KF Flags (Menu) – Miscellaneous keyframe flags, currently used to turn Globals off and on.

kHz (Kilohertz) – One thousand cycles per second.

Kilobyte – One thousand bytes. Actually 1024 bytes because of the way computer math works out.

Kinescope – Frequently used to mean picture tubes in general. However, this name has been copyrighted.

Kinescope Recording – Motion pictures taken of a program photographed directly from images on the face of a kinescope tube. A television transcription.

Knee – By convention, the circuitry introducing white compression into the opto-electric transfer function and thereby modifying the curve for a more gradual approach to white clip.

K_{pulse/bar} or K-PB – Calculation of this parameter requires the measurement of the pulse and bar amplitudes. K_{pulse/bar} is equal to:

$$1/4 | (\text{bar-pulse})/\text{pulse} | \times 100\%$$

► **L**

Label – Name assigned to a memory location. When an assembly language program is written, a label is assigned to an instruction or memory location that must be referred to by another instruction. Then when the program is converted to machine code, an actual address is assigned to the label.

LAeq – An Leq measurement using “A” weighting. Refer to Leq and Weighting.

LAN – Local Area Network.

LANC – See Control-L.

LAP – Link Access Protocol.

Lap Dissolve – A slow dissolve in which both pictures are actually overlapped for a very brief period of time. Same as Dissolve.

Large Scale Integration (LSI) – Technology by which thousands of semiconductor devices are fabricated on a single chip.

Large-Area Flicker – Flicker of the overall image or large parts of it. See also Flicker Frequency and Twitter.

Laser Beam Recording – A technique for recording video on film.

LAT – Link Available Time.

Latch – **a)** Hardware device that captures information and holds it (e.g., group of flip-flops). **b)** An electronic circuit that holds a signal on once it has been selected. To latch a signal means to hold it on or off.

Latency – A factor of data access time due to disk rotation. The faster a disk spins the quicker it will be at the position where the required data can start to be read. As disk diameters have decreased, so rotational speeds have tended to increase but there is still much variation. Modern 3-1/2-inch drives typically have spindle speeds of between 3,600 and 7,200 revolutions per minute, so one revolution is completed in 16 or 8 milliseconds (ms) respectively. This is represented in the disk specification as average latency of 8 or 4 ms.

Lateral Direction – Across the width of the tape.

Launch – To start up an application, often by double-clicking an icon.

Lavalier – A microphone designed to hang from the performer's neck.

Layer – **a)** A term used to describe which video is on top of which background versus foreground and subsequent keys superimposed. **b)** One of the levels in the data hierarchy of the video and system specification.

Layer-to-Layer Adhesion – The tendency for adjacent layers of tape in a roll to adhere to each other.

Layer-to-Layer Signal Transfer – The magnetization of a layer of tape in a roll by the field from a nearby recorded layer, sometimes referred to as “print-thru.”

LBR (Laser Beam Recorder) – It creates the DVD master file.

LCD (Liquid Crystal Display) – A screen for displaying text/graphics based on a technology called liquid crystal, where minute currents change the reflectiveness or transparency of selected parts of the screen. The

advantages of LCD screens are: very small power consumption (can be easily battery driven) and low price of mass produced units. Its disadvantages presently include narrow viewing angle, somewhat slower response time, invisibility in the dark unless the display is back-lit, difficulties displaying true colors, and resolution limitations.

LCP – Link Control Protocol.

Leader – Special non-magnetic tape that can be spliced to either end of a magnetic tape to prevent damage and possible loss of recorded material and to indicate visually where the recorded portion of the tape begins and ends.

Leading Blacks – A term used to describe a picture condition in which the edge preceding a white object is overshadowed toward black. The object appears to have a preceding or leading black border.

Leading Whites – A term used to describe a picture condition in which the edge preceding a black object is overshadowed toward white. The object appears to have a preceding or leading white border.

Leakage – A term describing the signal picked up by a mike which is intended to pick up other signals only.

Learn – The act of storing switcher control panel data into memory in a real-time mode (learning as they happen).

Learning Curve – An algebraic metaphor for the amount of time a learner needs to learn a new task (such as operating an item of television production equipment).

Least Significant Bit (LSB) – The bit that has the least value in a binary number or data byte. In written form, this would be the bit on the right. For example:

Binary 1101 = Decimal 13

In this example, the rightmost binary digit, 1, is the least significant bit, here representing 1. If the LSB in this example were corrupt, the decimal would not be 13 but 12.

Lechner Distance – Named for Bernard Lechner, researcher at RCA Laboratories. The Lechner distance is nine feet, the typical distance Americans sit from television sets, regardless of screen size. The Jackson distance, three meters, named for Richard Jackson, a researcher at Philips in Britain, is similar. There is reason to believe that the Lechner and Jackson distances are why HDTV research was undertaken sooner in Japan (where viewing distances are shorter) than elsewhere. See also Viewing Distance.

LED – A light on a piece of hardware that indicates status or error conditions.

Legal Signal – A video signal in which each component remains within the limits specified for the video signal format; that is, it does not exceed the specified gamut for the current format.

Lempel-Ziv Welch (LZW) Compression – Algorithm used by the UNIX compress command to reduce the size of files, e.g., for archival or transmission. The algorithm relies on repetition of byte sequences (strings) in its

Line Doubling – Any number of schemes to convert interlaced scanning to progressive scanning at the display, the simplest of which simply doubles each scanning line. More elaborate schemes use line interpolation and motion compensation or median filtering.

Line Frequency – The number of horizontal scans per second, normally 15,734.26 times per second for NTSC color systems and 15,625 in PAL.

Line Interpolation – An advanced mechanism used in some line doublers that calculates the value of scanning lines to be inserted between existing ones.

Line Mode – A Dolby Digital decoder operational mode. The dialnorm reference playback level is -31 dBFS and dynamic range words are used in dynamic range compression. Refer to Dynamic Range Compression.

Line Pair – A measure of resolution often used in film and print media. In television, lines are used instead, creating confusion when comparing film and video.

Line Pair, Optical – In optical measurements and specifications, resolution is specified in terms of line-pairs per unit distance or unit angle, a line pair consisting of one “black” plus one “white” line. Thus one line pair corresponds to two television lines.

Line Pairing – A reduction in vertical resolution caused when a display (or camera) does not correctly space fields, resulting in an overlap of odd and even numbered scanning lines. See also Random Interlace.

Line Rate – The rate at which scanning lines appear per second (the number of scanning lines per frame times the frame rate); sometimes used (non-quantitatively) as an indication of the number of scanning lines per frame (e.g., a high line rate camera).

Line Rate Conversion – Standardized video systems currently exist employing the following number of total lines per frame: 525, 625, 1125. Furthermore, each of these operates in a 2:1 interlace mode, with 262.5, 312.5, 562.5 lines per field (with concurrent temporal differences at field rates of 50.00, 59.94, or 60.00 fields per second). Additional systems are being proposed. While simple transcoding by deletion or repetition can be applied, it is more commonly done by applying an algorithm to stored information in order to generate predictive line structures in the target system.

Line Store – A memory buffer which stores a single digital video line. One application for line stores is use with video filtering algorithms or video compression applications.

Line Structure Visibility – The ability to see scanning lines. Seeing them makes it harder to see the image (like looking out a window through venetian blinds or not being able to see the forest for the trees). Some ATV schemes propose blurring the boundary between scanning lines for this reason.

Line Time Linear Distortions – Distortions involving signals in the 1 μ sec to 64 μ sec range. These distortions cause tilt in line-rate signal components such as white bars. The amount of distortion is expressed in IRE or as a percent of the line bar amplitude. Line time distortions can also be quantified in K_{bar} units. In large picture details, this distortion produces brightness variations between the left and right sides of the screen. Horizontal streaking and smearing may also be apparent. Any test signal containing an 18 μ sec, 100 IRE bar such as the FCC Composite or the

NTC-7 Composite can be used for this measurement. See the discussion on Linear Distortions and K_{bar} units.

Line Time Waveform Distortion – See Line Time Linear Distortions.

Linear Addressing – A modern method of addressing the display memory. The display memory (in the IBM PC world) was originally located in a 128-Kbyte area from A000:0 through BFFF:F, too small for today’s display systems with multi-megabyte memories. Linear addressing allows the display memory to be addressed in upper memory, where a large contiguous area is set aside for it.

Linear (Assembly) Editing – Editing using media like tape, in which material must be accessed in order (e.g., to access scene 5 from the beginning of the tape, one must proceed from scene 1 through scene 4). See Nonlinear Editing.

Linear Distortion – Distortions which are independent of signal amplitude. These distortions occur as a result of the system’s inability to uniformly transfer amplitude and phase characteristics at all frequencies. When fast signal components such as transitions and high frequency chrominance are affected differently than slower line-rate or field-rate information, linear distortions are probably present. These distortions are more commonly caused by imperfect transfer characteristics in the signal path. However linear distortions can also be externally introduced. Signals such as power-line hum can couple into the video signal and manifest themselves as distortions.

Linear Key – a) A term given to a key which contains soft edges and information at many different luminance levels. This is the ability of the keyer to key many levels linearly and means the keyer has a gain close to one. **b)** A process for the selective overlay of one video image upon another, as through chroma key. Control of the ratio of foreground to background is determined by the specifications derived from luminance information, and provided in the linear key data. Ratios to be applied are carried for each picture element in the alpha channel. The process permits realistic rendering of semi-transparent objects.

Linear PCM – One of the allowed types of audio formats for DVD. It may have up to eight channels and provide very high sample rates and sample depths. Unfortunately, these very high data rates consume so much DVD capacity that meaningful quantities of both audio and video become problematic.

Linear Pulse Distribution Amplifier (Linear Pulse DA) – A linear pulse distribution amplifier will handle 4 Vp-p signals (pulses) but is limited to amplifying and fanning out the signal. Also see Regenerative Pulse DA.

Linear Select Decoding – Address decoding technique that uses the most significant address bits to directly enable devices in the system.

Linear Time Code (LTC) – Time code recorded on a linear analog track on a video tape.

Linearity – a) The basic measurement of how well analog to digital and digital to analog conversion are performed. To test for linearity, a mathematically perfect diagonal line is converted and then compared to a copy of itself. The difference between the two lines is calculated to show linearity of the system and is given as a percentage or range of Least Significant Bits. **b)** The uniformity of scanning speed which primarily affects the accu-

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racy of geometry along a horizontal or vertical line through the picture center. **c)** The measurement of how accurately a piece of electronic equipment processes a signal (a measure of its transparency).

Line-Out Monitor – A monitor connected to a recording device that displays the finished product. A line-out monitor may be a video monitor (video product), an audio speaker (audio product), or a television (both audio and video).

Liners/Friction Plates – Friction controlling plastic sheets used inside a Philips cassette to control winding uniformity and torque level.

Lines – Scanning lines or lines of resolution. The latter are hypothetical lines alternating between white and black (or, in the case of chroma resolution, between complementary colors). The combined maximum number of black and white lines that might be perceived in a particular direction is the number of lines of resolution. Vertical resolution is measured with horizontal lines; horizontal resolution is measured with vertical lines; diagonal resolution is measured with diagonal lines (no current television system or proposal favors one diagonal direction over the other, so the direction of the diagonal lines does not really matter). See also PPH.

Lines, Active Horizontal – In the scanning of a video image, the line number associated with the format is the total number of lines assigned to one frame. It is in fact a timing specification defining the conjunction with the field frequency the time interval allocated to each horizontal line (commonly measured in number of samples at the specified sampling rate or in microseconds). Some of these lines and intervals carry image information, some from the total assigned are dedicated to operational and control functions, including returning the scanning beam back to the upper left corner to begin the next field. Those allotted time intervals (lines) actually carrying image information or image-associated information such as captioning, image test signals, etc., are the active lines. In further reduction of time allocated to image information, some of each active line is dedicated to the horizontal interval to get the scanning beam to return to the left-edge starting point for the next line and to reaffirm color subcarrier, etc. In the U.S. 525/59.94/2:1/NTSC system, about 7.6% of the total field or frame time is assigned to the vertical interval, and about 16% to the horizontal interval. Thus, the 525 television lines per frame provide about 480 active lines. Correspondingly, each active line displays image data about 84% of its time interval. Image information is thus conveyed for only about 76.4% of the total time. In digital encoding, it may be possible to reduce the number of bits assigned to the vertical and horizontal intervals and achieve significant bit rate reduction.

Lines, Active Vertical – In a scanning standard, the number of raster lines per frame that are not required to contain blanking. The active vertical lines may include signals containing non-image information.

Lines, Television – Television images are scanned in a sequence of horizontal lines, beginning at the upper left corner, and reaching the bottom right corner at the end of the field. Thereupon the scan is returned to the upper left corner to begin the next field. As a consequence of the line structure, all television images are sampled vertically. Within a line, the signal may remain analog or be sampled digitally. A television line is also a measure of time, representing the interval allocated to one line. (In the U.S. system 525/59.94/2:1, the line duration is 63.5 μ s). Television lines also function as a geometric measure, with resolution (both vertical and hori-

zontal), for example, specified in terms of “lines per picture height.” Since both “black” and “white” lines of a resolution chart are counted, two television lines equal one cycle of the electrical waveform.

List Box – Used to make a selection from a list of options. If the list is too long to fit inside the given area, a vertical scroll bar moves the list up and down.

Listener – Device that inputs data from a data bus.

Little Endian – A process which starts with the low-order byte and ends with the high-order byte. Intel processors use the little endian format.

Live – Actually presented in the studio, with cameras feeding out to the lines as the performance is done.

LLC – Link Layer Control.

LLME – Lower Layer Management Entity.

L-Member – Liaison Member.

LMDS – Local Multi-Point Distribution System.

LNB – Low-Noise Block Converter.

LO – Local Origination Channel.

Local Bus Transfer – The host/local bus transfer consumes a smaller percentage of available bandwidth during video/graphics transfers than earlier bus standards but the still-noticeable performance penalty may be objectionable for some users, especially when compared to systems that circumvent it.

Local Decode – A feature of Indeo video interactive allowing the playback application to tell the codec to decode only a rectangular subregion of the source video image: the viewport. See Viewport.

Load Resistance – The impedance or resistance (load) that a cable places on a signal being transmitted through it. In the case of a high-frequency signal, signal-to-cable matching is essential to prevent signal deterioration. The cable should be terminated by a specific load resistance, usually 50 or 75 ohms. Improper cable loading results in signal distortion, ghost images, color loss, and other adverse phenomena. Most video inputs have the proper termination built in.

Local Tally – A tally of which bus on an M/E is active regardless of whether or not it is on air.

Local Workstation, Drive, Disk, File System, or Printer – The physical workstation whose keyboard and mouse you are using, all hardware that is connected to that workstation, and all software that resides on that hardware or its removable media.

Locate (Menu) – The 3D function used to move or relocate an image. Locate moves the image as if it were in three-dimensional space, even though the image is seen on a two-dimensional video screen.

Location – Shooting locale.

Locked – A video system is considered to be locked when the receiver is producing horizontal syncs that are in time with the transmitter.

Locking Range – The time range measured in micro- or nanoseconds over which a video decoder can “lock” or stabilize a signal. Digital out of

range signals may require “rubber-band” buffering using a parallel shift register (FIFO) to reduce the locking range.

Lock-Up Time – The time before a machine is activated and the time it is ready for use.

LOF – Loss of Frame.

Lofting – The ability to stretch a “skin” over shapes that are in fact cross-sectional ribs.

Logarithm – A logarithm is the power to which a base (usually 10) must be raised in order to arrive at the desired value.

Logarithmic Scale – A mathematical function which spreads out low values and squeezes together higher values.

Logic Analyzer – Test system capable of displaying 0s and 1s, as well as performing complex test functions. Logic analyzers typically have 16 to 32 input lines and can store sequences of sixteen or more bits on each of the input lines.

Logic Comparator – Test product that compares pin-for-pin operation of an IC operating in-circuit with a known good reference IC.

Logic Probe – Handheld troubleshooting tool that detects logic state and activity on digital circuit nodes.

Logic Pulser – Handheld troubleshooting tool that injects controlled digital signals into logic nodes.

Login – To log in to a workstation is to establish a connection to the workstation and to identify yourself as an authorized user.

Login Account – A database of information about each user that, at the minimum, consists of login name, user ID, and a home directory.

Login Name – A name that uniquely identifies a user to the system.

Login Screen – The window that you see after powering on the system, before you can access files and directories.

Logout – To log out from a workstation is to finish a connection to the workstation.

Long Shot – Camera view of a subject or scene, usually from a distance, showing a broad perspective.

Long-Time Linear Distortions – Distortions involving signals in the greater than 16 msec range. Long-time distortions affect slowly varying aspects of the signal such as changes in APL which occur at intervals of a few seconds. The affected signal components range in duration from 16 msec to tens of seconds. The peak overshoot, in IRE, which occurs as a result of an APL change is generally quoted as the amount of distortion. Settling time is also sometimes measured. Long-time distortions are slow enough that they are often perceived as flicker in the picture. See the discussion on Linear Distortions.

Longitudinal Curvature – Any deviation from straightness of a length of tape.

Longitudinal Direction – Along the length of the tape.

Longitudinal Time Code (LTC) – Audio-rate time code information that is stored on its own audio track. This audio-rate signal allows the editing sys-

tem to track the position of the tape even at high shuttle speeds where VITC data could not be used.

Look Ahead Preview – See Preview.

Loop – Piece of tape spliced beginning (head) to end (tail) for continuous playback or recording. To fold around. A loop/slack section of film with the necessary “play” to allow film which had been previously and continuously moving from a reel to be intermittently moved through a grate/projection head/optical lens arrangement. Proper loop size is important in threading a film projector, i.e., in telecine for film to videotape transfer.

Loop Through – A video signal entering a piece of equipment is returned to the outside world for further use. Loop through circuitry requires careful design to prevent signal degradation.

Looping – a) A term used to describe the chaining of a video signal through several video devices (distribution amplifiers, VCRs, monitors, etc.). A VCR may be hooked up to a distribution amplifier which is supplied with a video input connector and a loop output connector. When a signal is fed to the distribution amplifier, it is also fed unprocessed to the loop output connector (parallel connection) on the distribution amplifier. In turn, the same signal is fed to another device which is attached to the first one and so on. Thus a very large number of VCRs or other video devices can be looped together for multiple processing. **b)** An input that includes two connectors. One connector accepts the input signal, and the other connector is used as an output for connecting the input signal to another piece of equipment or to a monitor.

Lo/Ro (Left Only, Right Only) – A type of two-channel downmix for multi-channel audio programs. Lo/Ro downmixes are intended for applications where surround playback is neither desired nor required.

Loss – Reduction in signal strength or level.

Lossless (Compression) – a) Reducing the bandwidth required for transmission of a given data rate without loss of any data. **b)** Image compression where the recovered image is identical to the original. See Lossy (Compression).

Lossy (Compression) – a) Image compression where the recovered image is different from the original. **b)** Compression after which some portion of the original data cannot be recovered with decompression. Such compression is still useful because the human eye is more sensitive to some kinds of information than others, and therefore does not necessarily notice the difference between the original and the decompressed image. **c)** Reducing the total data rate by discarding data that is not critical. Both the video and audio for DTV transmission will use lossy compression. See Lossless (Compression).

Low Band Color – The old, original professional videotape color recording.

Low Delay – A video sequence does not include B-pictures when the low delay flag is set; consequently, the pictures follow in chronological order, and low delay is obtained. Normally, when B-pictures are included, the pictures used for prediction of a B-picture are sent in advance so they are available when the B-picture arrives, but this increases the delay.

Low End – The lowest frequency of a signal. See High End.

Low Impedance Mike – A mike designed to be fed into an amplifier or transformer with input impedance of 150 to 250 ohms.

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Low-Frequency Amplitude Distortion – A variation in amplitude level that occurs as a function of frequencies below 1 MHz.

Low-Frequency Distortion – Distortion effects which occur at low frequency. Generally considered as any frequency below the 15.75 kHz line frequency.

Low-Order – Pertaining to the weight or significance assigned to the digits of a number. In the number 123456, the lower order digit is six. The three low-order bits of the binary word 11100101 are 101.

Lowpass Filter – **a)** Filter that passes frequencies below a specific frequency. **b)** A filter specifically designed to remove frequencies above the cutoff frequency, and allow those below to pass unprocessed is called a lowpass filter. The effect of a lowpass filter is to reduce the amplitude of high frequencies. Common examples include the “treble” controls on many lower end radios and stereos, the passive “tone” controls often found on electric guitars and basses, hi-cut filters on consoles, and of course, this type of filter is found on many synthesizers.

LPCM (Linear Pulse Code Modulation) – A pulse code modulation system in which the signal is converted directly to a PCM word without compressing, or other processing. Refer to PCM.

LPTV – Low Power TV.

LSB – See Least Significant Bit.

LSI – See Large Scale Integration.

LS/RS (Left Surround, Right Surround) – The actual channels or speakers delivering discrete surround program material.

LSTTL (Low Power Schottky TTL) – Digital integrated circuits that employ Schottky diodes for improved speed/power performance over standard TTL.

LTC – See Linear Time Code or Longitudinal Time Code.

Lt/Rt (Left Total, Right Total) – Two-channel delivery format for Dolby Surround. Four channels of audio, Left, Center, Right and Surround (LCRS) are matrix encoded for two-channel delivery (Lt/Rt). Lt/Rt encoded programs are decoded using Dolby Surround and Dolby Surround Pro Logic decoders. Refer to Dolby Surround and Dolby Surround Pro Logic.

Luma – See the definition for Luminance.

Luminance (Component) – A matrix, block or single pel representing a monochrome representation of the signal and related to the primary colors in the manner defined in the bit stream. The symbol used for luminance is Y.

Luminance (Y) – Video originates with linear-light (tristimulus) RGB primary components, conventionally contained in the range 0 (black) to +1 (white). From the RGB triple, three gamma-corrected primary signals are computed; each is essentially the 0.45-power of the corresponding tristimulus value, similar to a square-root function. In a practical system such as a television camera, however, in order to minimize noise in the dark regions of the picture it is necessary to limit the slope (gain) of the curve near black. It is now standard to limit gain to 4.5 below a tristimulus value of +0.018, and to stretch the remainder of the curve to place the Y-intercept

at –0.099 in order to maintain function and tangent continuity at the breakpoint:

$$R_{\text{gamma}} = 1.099 * \text{pow}(R, 0.45) - 0.099$$

$$G_{\text{gamma}} = 1.099 * \text{pow}(G, 0.45) - 0.099$$

$$B_{\text{gamma}} = 1.099 * \text{pow}(B, 0.45) - 0.099$$

Luma is then computed as a weighted sum of the gamma-corrected primaries:

$$Y = 0.299 * R_{\text{gamma}} + 0.587 * G_{\text{gamma}} + 0.114 * B_{\text{gamma}}$$

The three coefficients in this equation correspond to the sensitivity of human vision to each of the RGB primaries standardized for video. For example, the low value of the blue coefficient is a consequence of saturated blue colors being perceived as having low brightness. The luma coefficients are also a function of the white point (or chromaticity of reference white). Computer users commonly have a white point with a color temperature in the range of 9300 K, which contains twice as much blue as the daylight reference CIE D65 used in television. This is reflected in pictures and monitors that look too blue. Although television primaries have changed over the years since the adoption of the NTSC standard in 1953, the coefficients of the luma equation for 525- and 625-line video have remained unchanged. For HDTV, the primaries are different and the luma coefficients have been standardized with somewhat different values. The signal which represents brightness, or the amount of light in the picture. This is the only signal required for black and white pictures; for color systems it is obtained as the weighted sum ($Y = 0.3R + 0.59G + 0.11B$) of the R, G, and B signals.

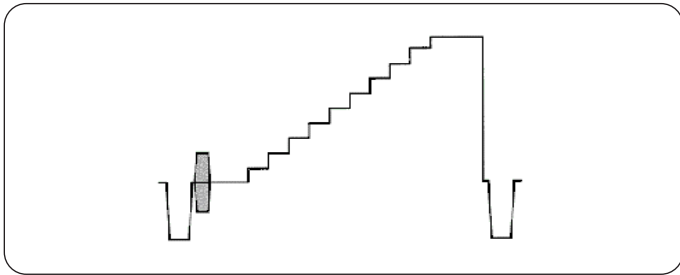
Luminance Factor β – At a surface element of a nonself-radiating medium, in a given direction, under specified conditions of illumination, ratio of the luminance of the surface element in the given direction to that of a perfect reflecting or transmitting diffuser identically illuminated. No “perfect reflectors” exist, but properly prepared magnesium oxide has a luminance factor equal to 98% and this is usually employed to define the scale.

Luminance Key – A key wherein the keying signal is derived from the instantaneous luminance of a video signal after chroma has been filtered out. That is, for a particular clip level, all parts of a scene that are brighter than that level will appear keyed in, leaving background video everywhere else.

Luminance Noise – Noise which manifests itself in a video picture as white snow, typically caused by one of the following situations: low signal level due to poor lighting conditions, poor video signal processing, low quality videotapes, excessively long video cables used without pre-compensation, dirt on the video recorder heads which interferes with reading and writing, over-enhancement of the video signal.

Luminance Nonlinearity – This distortion is also called differential luminance and is present if luminance gain is affected by luminance levels.

This amplitude distortion is a result of the system's inability to uniformly process luminance information over the entire amplitude range.



The amount of luminance nonlinearity distortion is expressed as a percentage. Measurements are made by comparing the amplitudes of the individual steps in a staircase signal as shown. The result is the difference between the largest and smallest steps, expressed as a percentage of the largest step. Measurements should be made at both high and low APL and the worst error should be quoted. In black and white pictures, luminance nonlinearity will cause pictures loss of detail in shadows and highlights which are caused by the crushing or clipping of the white or black portions of the signal. In color pictures, luminance nonlinearity will cause colors in the high luminance portions of the picture to be distorted.

Luminance Range – The range in measured luminance between the lightest and the darkest element of a luminous scene or its display.

Luminance Range, Display CRT – The luminance range that can be displayed on a CRT is the ratio of maximum to minimum luminance on the tube face. The maximum practical output is determined by beam current, phosphor efficiency, shadow-mask distortion, etc. The minimum is the luminance of that portion of the tube face being scanned with beam current set to cut-off. The contributions from room illumination, external and internal reflections, etc., must be recognized.

Luminance Range, Display Theater – The luminance range that can be displayed on a theater projection screen is the ratio of maximum to minimum luminance achievable during projection of film. The maximum achievable highlight is determined by light-source output capacity, projection optical efficiency, the transmission of minimum film densities, screen gain, etc. The minimum is the luminance contribution from house illumination and other stray light, plus optical flare raising black levels, and the transmission of maximum film densities. Measured values in typical first-run theaters show luminance ranges of 500:1 to 300:1 (usually limited by house illumination).

Luminance Range, Recorded – The luminance range, recorded may be reduced from the luminance range, scene intentionally and/or by the limitations of the recording system. Most systems have a maximum effective signal level limiting the high end, and noise limiting the low end. All of the scene that is of interest must be placed within these two limits by the choice of an appropriate transfer function. Some analog functions permit gradual transitions to overload and/or noise. Digital functions have inflexible limits imposed by the number of levels permitted by the bit assignments.

Luminance Range, Scene – The luminance range of original scenes varies from outdoor scenes in sunlight with a range possibly exceeding

10000:1, to indoor scenes with controlled lighting, where the range may be reduced to 10:1 or even less. Adjustment of or accommodation to the luminance range, scene is one of the conditions to be evaluated in determining how the scene is to be recorded. It is a test of artistic judgment to place the relative luminances for the objects of interest on a suitable portion of the opto-electronic or opto-photographic transfer function in order to produce the desired subjective quality.

Luminance Signal – The black and white signal (the brightness signal) in color TV. The luminance signal is formed by combining a proportion of 30% red, 50% green, and 11% blue from the color signal. This combined output becomes the luminance (brightness/monochrome) signal.

Luminance, Constant (Video) – In an image coding system that derives a luminance signal and two bandwidth-limited color-difference signals, constant luminance prevails if all of the luminance information is encoded into one signal that is supplemented by but totally independent of two color signals carrying only chrominance information, e.g., hue and saturation. Constant luminance is only achieved when the luminance and chrominance vectors are derived from linear signals. The introduction of nonlinear transform characteristics (usually for better signal-to-noise and control of dynamic range prior to bandwidth reduction) before creating the luminance and chrominance vectors destroys constant luminance. Current video systems do not reconstitute the luminance and chrominance signals in their linear form before further processing and, therefore, depart from constant luminance. Note: When R, G, B information is required to be recovered from the set of luminance and color-difference signals, the values correlated to the original signals are obtained only if the luminance and chrominance signals have been derived from the linear functions of R, G, B or have been transformed back to linear. Constant luminance not only provides a minimum of subjective noise in the display (since the luminance channel does not respond to chrominance noise), but also preserves this noise minimum through chrominance transformations.

Luminance, Physics (Generic Usage) – a) Luminance has technical as well as colloquial definitions. The generic flux from a light-emitting or light-reflecting surface; the subjective response to luminance is brightness. The quotient of the luminous flux at an element of the surface surrounding the point and propagated in directions defined by an elementary cone containing the given direction, by the product of the solid angle of the cone and the area of the orthogonal projection of the element of the surface on a plane perpendicular to the given direction. **b)** The luminous flux may be leaving, passing through, and arriving at the surface or both. The luminance for each element of a surface within the field of view is defined as the ratio of luminous flux per solid angle to the unit projected area of the surface. Units are candelas per square meter, foot lamberts, nits.

Luminance, Relative, Scene – A convenient linear scale for measuring, in arbitrary units, the relative luminance amplitudes within the scene to be recorded in a video or photographic image, as shown below. The relative luminance scale is one factor affecting the choice of suitably artistic scene reproduction. It may establish the optimum rendition of reference white and optimum employment of the nonlinear transfer function in image recording. Note: This relative luminance scale (linear in luminance) resembles IRE units (linear in voltage) in positioning both black level reference and refer-

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ence white at 0 and 100, respectively, but that it differs in recognizing the extended luminance range of many commonly encountered scenes.

Correlation of Relative Scene Luminance

	Reflectance Factor %	Relative Scene Luminance ⁽¹⁾ Scale	Relative Camera Stops
Typical Limit of Interest	–	640	+5
	–	320	+4
	–	160	+3
Reference White ⁽²⁾	90	100	–
	–	80	+2
	–	40	+1
Gray Card ⁽³⁾	18	20	0
	–	10	1
	–	5	–2
Scene Black	0	0	–

- (1) IEEE Dictionary of Electrical and Electronics Terms defines luminance factor as the ratio to a perfect reflector rather than as the ratio to reference white. In practical electronic production, relative scene luminance is a more useful measure.
- (2) Under scene illumination, the light from a nonselective diffuse reflector (white card) whose reflectance is 90% compared to a perfect reflector (prepared magnesium oxide = 98%).
- (3) Under scene illumination, the light from a nonselective diffuse reflector (gray card) whose reflectance is 18% compared with that of a perfect reflector.

Luminance, Television – a) When television was monochrome and sensors were in approximate conformance to CIE Photopic Spectral Luminous Efficiency Function, it became common to think of the video signal as the luminance signal. With the introduction of color, a matrix was designed to develop a luminance function by weighting the R, G, B signals in accor-

dance with the CIE Photopic Spectral Luminance Efficiency Function, producing a video signal compatible with monochrome receivers. **b)** A signal that has major control of the image luminance. It is a linear combination of gamma-corrected primary color signals. **c)** The specific ratio of color primaries that provides a match to the white point in a specified color space. **d)** The definition of luminance, television is identical for NTSC, PAL, and SECAM (CCIR Report 624-4), as follows: $E'Y = (0.299) E'R + (0.587) E'G + (0.014) E'B$. The weighting function is named luminance signal in all of the television standards. For convenience and bandwidth conservation, however, it is always formed from the gamma correction signals (i.e., R', G', B') and not from the initial linear signals, and thus it is not an exact representation of luminance, physics.

Luminescence – The absorption of energy by matter and its following emission as light. If the light follows and then completes itself quickly after absorption of the energy, the term fluorescence is used. If the process is of a longer and more persistent length, the term phosphorescence is applied.

Luminous Flux – a) The time rate of flow of light. **b)** The time rate of flow of radiant energy evaluated in terms of a standardized visual response. Unless otherwise indicated, the luminous flux is defined for photopic vision. The unit of flux is the lumen: the luminous flux emitted within unit solid angle by a point source having an isotropic luminous intensity of 1 candela.

Lux – a) The metric unit for illumination is 1 lumen per square meter. 1 foot candle = 10.76 Lux. **b)** A measurement of light. Lux is used in television production to determine the minimum amount of light (lux rating) needed for camera operation. Hence, a “2 lux” camcorder requires less light than a “4 lux” camcorder.

LV (LaserVision) – Technology used in optical video disk.

LVDS – Low Voltage Differential Signal.

▶ **M**

M – The CCIR designation for 525 scanning-line/30 frame-per-second television. U.S. color television is internationally designated NTSC-M. The M standard is the world's second oldest (the oldest was a 405-line/25 frame British standard, no longer broadcast).

M and E Tracks – Stands for music and effects audio tracks.

M Load – The cassette tape loading mechanism used in VHS videotape recorder/playback technology.

M/E – See Mix Effects.

M/E Reentries – Those buttons on a bus that allow selection of previous M/Es for further processing to be overlaid.

M/E to M/E Copy – A panel memory enhancement allowing the operator to copy all parameters from one M/E to another with three keystrokes.

M/E to M/E Swap – A panel memory enhancement allowing the operator to swap all parameters between two M/Es with three keystrokes. All parameters include key clip levels, pattern position, all hues and modifiers used as long as the M/Es are similarly equipped.

M2 – See Miller Squared Code.

MAA – MPEG ATM Adaptation.

MAC (Multiplexed Analog Components) – a) A system in which the components are time-multiplexed into one channel using time-domain techniques; that is the components are kept separate by being sent at different times through the same channel. There are many different MAC formats and standards. **b)** A means of time multiplexing component analog video down a single transmission channel such as coax, fiber, or a satellite channel. Usually involves digital processes to achieve the time compression. **c)** A large family of television signal formats sharing the following two characteristics: color remains in a component rather than composite form, and luminance and chrominance components are time compressed so that active line time remains constant, with chrominance following luminance. Most of the MACs also include digital audio/data channels. Since they are non-composite, MACs do not suffer from any cross-luminance or cross-color effects. Since they are time compressed, they tend to have a greater base bandwidth than composite signals. See also ACLE, A-MAC, B-MAC, D-MAC, D-MAC, D2-MAC, HD-MAC, HD-MAC60, MAC-60, MUSE, and S-MAC.

MAC-60 – An early version of the HDMAC-60.

Machine Code – See Machine Language.

Machine Cycle – Basic period of time required to manipulate data in a system.

Machine Error – A machine hardware malfunction.

Machine Language – Binary language (often represented in hexadecimal) that is directly understood by the processor. All other programming languages must be translated into binary code before they can be entered into the processor.

Machine Operator – A person trained in the operation of a specific machine.

Macro Lens – A lens used for videography when the camera-to-object distance is less than two feet. The macro lens is usually installed within the zoom lens of the video camera or camcorder.

Macroblock – a) The four 8 by 8 blocks of luminance data and the two (for 4:2:0 chroma format), four (for 4:2:2 chroma format) or eight (for 4:4:4 chroma format) corresponding 8 by 8 blocks of chrominance data coming from a 16 by 16 section of the luminance component of the picture. Macroblock is sometimes used to refer to the pel data and sometimes to the coded representation of the pel values and other data elements defined in the macroblock header. The usage should be clear from the context. **b)** The screen area represented by several luminance and color-difference DCT blocks that are all steered by one motion vector. **c)** The entity used for motion estimation, consisting of four blocks of luminance components and a number of corresponding chrominance components depending on the video format.

Macrovision – An analog protection scheme developed by Macrovision for the prevention of analog copying. It is widely used in VHS and has now been applied to DVD.

Mag Track – This term usually refers to the sound track. It is usually used only in reference to the separate sound tape used in double system recording and editing. Videotape is a magnetic medium too, but the term mag track is only used in reference to sound tape and not to sound on a videotape picture.

Magnetic Density – The amount of magnetic flux within a specific area.

Magnetic Field – An area under the influence of magnetism.

Magnetic Film – Sprocketed base with a magnetic coating for audio recording and playback.

Magnetic Force – The amount of magnetic influence/force within a specific area/field.

Magnetic Head – That part of a videotape recorder which converts electric variations into magnetic variations and vice versa.

Magnetic Induction – To magnetize by being put within the magnetic influence of a magnetic field.

Magnetic Instability – The property of a magnetic material that causes variations in the residual flux density of a tape to occur with temperature, time, and/or mechanical flexing. Magnetic instability is a function of particle size, magnetization, and anisotropy.

Magnetic Recording – The technology and process of recording audio/video information using magnetism as the medium for storage of information. The term is often used to mean the process/capability of both recording and reproduction/playback.

Magnetic Tape – With a few exceptions, magnetic tape consists of a base film coated with magnetic particles held in a binder. The magnetic particles

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are usually of a circular shape and approach single domain size. See Gamma Ferric Oxide, Chromium Dioxide, and Cobalt Doped Oxide.

Magnetic Track – A sound-track recorded on magnetic film or tape.

Magnetism – The property of certain physical materials to exert a force on other physical materials, and to cause voltage to be induced in conducting bodies moving relative to the magnetized body.

Magnetizing Field Strength, H – The instantaneous strength of the magnetic field applied to a sample of magnetic material.

Main Channel – The basic transmission channel of an ATV channel using an augmentation channel.

Main Level – A range of allowed picture parameters defined by the MPEG-2 video coding specification with maximum resolution equivalent to ITU-R Recommendation 601.

Main Profile – A subset of the syntax of the MPEG-2 video coding specification that is expected to be supported over a large range of applications.

Male Connector – A connector that has raised edges, pins, or other protruding parts that you plug into a female connector. An example of a male connector is an electrical plug that you plug into a wall outlet.

Man Page – An on-line document that describes how to use a particular IRIX or UNIX command.

Mantissa – Fractional value used as part of a floating point number. For example, the mantissa in the number 0.9873×10^7 is 0.9873.

Mapping – a) A technique for taking a 2D image and applying (mapping) it as a surface onto a 3D object. **b)** Conversion of bytes (8 bits) to 2n-bit wide symbols. Thus n is the bit width for the I and Q quantization; e.g., at 64 QAM the symbol width is $2n = 6$ bit, $n = 3$, i.e., I and Q are subdivided into $2^3 = 8$ amplitude values each. **c)** Refers to the definition of memory for storing data used by a particular display mode. The range of addresses reserved for graphics information in IBM-compatible systems is from A000:0 to BFFF:F.

Mark – Term used to describe the function of indicating to the editor where the entry or exit of the edit will be done on the fly.

Mask – a) A mask image is a black and white image, which defines how opaque each pixel is. A mask blocks out certain components of an image but lets other parts show through. **b)** Pattern used to selectively set certain bits of a word to 1 or 0. Usually ANDed or ORed with the data.

Mask Key – A key that is selectively limited in what portions of the key source will be allowed to cut the hole. Masks are usually square, however, on Ampex switchers mask keys are done by using the pattern system with any pattern shape on the switcher. See Preset Pattern.

Mask Programmed – An IC that is programmed by generating a unique photomask used in the fabrication of the IC.

Masking – Masking is one way of partial compensation for photo-receptor dot sensitivity, non-optimum color filters, non-ideal display phosphors, unwanted dye absorption. **Audio:** The phenomenon by which loud sounds prevent the ear from hearing softer sounds of similar frequency. The process of blocking out portions of a picture area/signal. A psychoacoustic phenomenon whereby certain sounds cannot be heard in the presence of others. **Video:** A process to alter color rendition in which the appropriate

color signals are used to modify each other. Note: The process is usually accomplished by suitable cross coupling between primary color-signal channels. **Photography:** Comparable control of color rendition is accomplished by the simultaneous optimization of image dyes, masking dyes, and spectral sensitivities.

Mass Storage – Secondary, slower memory for large files. Usually floppy disk or magnetic tape.

Master – The final edited tape recording from a session from which copies will be made called sub masters. These may be used for some subsequent editing to create other effects.

Master Reference Synchronizing Generator – A synchronizing pulse generator that is the precision reference for an entire teleproduction facility.

Master/Slave – Software option which allows user to maintain synchronization between two or more transports using one machine as control reference (master).

Mastering – The process of making a master pressing disc with a laser beam recorder and a metal plating process. This master is then used in the replication process to make thousands of copies. The process is conceptually similar to processes used to create vinyl LPs.

Mastering Lathe – A turntable and cutting head used to cut the disk from which the plates used to press records are made.

Matched Dissolve – A dissolve where the main object is matched in each camera.

Matched Resolution – A term sometimes used to describe matching the resolution of a television system to the picture size and viewing distance (visual acuity); more often a term used to describe the matching or horizontal and vertical (and sometimes diagonal) resolutions. There is some evidence that the lowest resolution in a system (e.g., vertical resolution) can restrict the perception of higher resolutions in other directions. See also Square Pixels.

Match-Frame Edit – Edit in which a scene already recorded on the master is continued with no apparent interruption. A match-frame edit is done by setting the record and source in-points equal to their respective out-points for the scene that is to be extended.

Material Editing – Each material has a number of attributes such as transparency, ambient, diffusion, refraction, reflection, and so on.

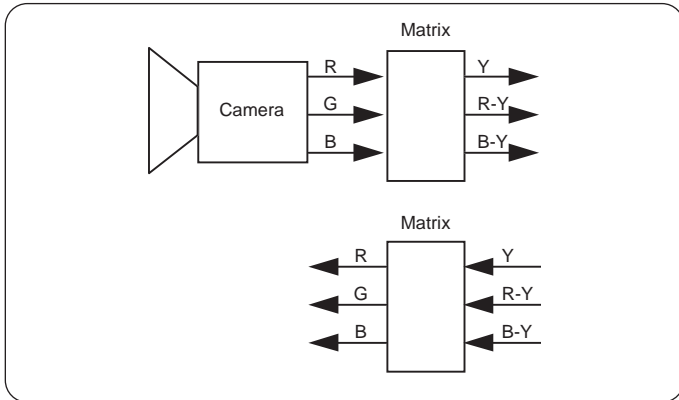
Mathias, Harry – Cinematographer, designer, teacher, consultant, and author who came up with the six priorities of electronic cinematography:

Harry Mathias' Priorities for Electronic Cimenatography
(in order of importance)

1. Practicality, Flexibility, and Ruggedness
2. Aspect Ratio
3. Sensitivity
4. Gamma or Transfer Characteristic
5. Resolution
6. Standards Acceptance (or Standards Conversion)

Matrix – a) Device that converts the RGB components from the camera into color difference signals and the reverse. **b)** A set of crosspoints in a

particular functional area of a switcher corresponding to a bus (the controls for that matrix). See Audio Matrix and Primary Matrix.



Matrix Switcher – A device which uses an array of electronic switches to route a number of audio/video signals to one or more outputs in almost any combination. Production quality matrix switchers perform vertical interval switching for interference free switching. Matrix switchers may be operated with RS-232 or RS-422 controls, enhancing flexibility.

Matrix Wipe – **a)** A wipe wherein the screen is divided into square areas, each of which can contain the video from either bus. Initially, each square contains the first bus video, and as the wipe develops, one or more squares switch to the opposite bus video until, at the completion of the wipe, all squares contain the second bus video. **b)** A type of wipe comprised of multiple boxes (a matrix of boxes) which turn on various parts of the “B” video during the course of a transition from the “A” video, until all the boxes have turned on the scene is all “B” video. This operates in either direction.

Matrixing – To perform a color coordinate transformation by computation or by electrical, optical, or other means.

Matsushita – Parent of Panasonic and Quasar, majority owner of JVC, first company to demonstrate an HD camera and display in the U.S., has continued demonstrations, and developed the QUME and QAM ATV schemes, which popularized the idea of quadrature modulation of the picture carrier.

Matte – An operational image or signal carrying only transparency information and intended to overlay and/or control a conventional image or image signal. **a)** Without shine or gloss. Relatively unreflective of light. Removal of a portion of a TV picture and replacement of it with another picture. **b)** A solid color, adjustable in hue, luminance, and saturation. Matte is used to fill areas of keys and borders. Ampex switchers generate many internal matte signal keys. **c)** A film term used to describe the film effect analogous to a key. Sometimes this definition is carried over into video and used to describe a video key. **d)** A black and white high contrast image that suppresses or cuts a hole in the background picture to allow the picture the matte was made from to seamlessly fit in the hole.

Matte Channel – See Alpha Channel.

Matte Edge – An undesirable, unwanted outline around a matted image. This is also called Matte Ring, Matte Ride, but more generally called a “bad matte.”

Matte Fill – A key filled with a solid color instead of “self,” which is the video cutting the key. This color is internally generated and adjustable in hue, luminance, and saturation.

Matte Generator – The circuitry which generates the matte.

Matte In – To add.

Matte Key – A key effect in which the inserted video is created by a matte generator.

Matte Out – To remove, eliminate.

Matte Reel – A black and white (hi con) recording on tape used as a key source for special effects.

MATV – Master Antenna TV.

Maximum Intrinsic Flux – In a uniformly magnetized sample of magnetic material, the product of the maximum intrinsic flux density and the cross-sectional area.

Maximum Intrinsic Flux Density – The maximum value, positive or negative, of the intrinsic flux density in a sample of magnetic material which is in a symmetrically, cyclically magnetized condition.

Maxwell – A unit of magnetic flux.

MB (Megabyte) – A standard unit for measuring the information storage capacity of disks and memory (RAM and ROM); 1000 kilobytes make one megabyte.

MBONE (Multicast Backbone) – A collection of Internet routers that support IP multicasting. The MBONE is used as a multicast channel that sends various public and private audio and video programs.

Mbps or Mb/s (Megabits Per Second) – A data transmission rate in millions of binary digits per second.

MBps or MB/s (Megabytes Per Second) – Data rate in millions of bytes per second.

MCI (Media Control Interface) – **a)** Microsoft’s interface for controlling multimedia devices such as a CD-ROM player or a video playback application. **b)** A high-level control interface to multimedia devices and resource files that provides software applications with device-independent control of audio and video peripherals. MCI provides a standard command for playing and recording multimedia devices and resource files. MCI is a platform-independent layer between multimedia applications and system lower-level software. The MCI command set is extensible inasmuch as it can be incorporated in new systems via drivers and can support special features of multimedia systems or file formats. MCI includes commands like open, play, and close.

MCPC (Multiple Channels Per Carrier) – An average satellite transponder has a bandwidth of 27 MHz. Typically, the highest symbol rate that can be used in SR 26 MS/s, and multiple video or audio channels can be transmitted simultaneously. MCPC uses a technique called Time Division Multiplex to transmit multiple programs, which works by sending data for one channel at a certain time and then data for another channel at another time. Many encoder manufacturers are currently experimenting with statistical multiplexing of MPEG-2 data. Using this technique, channels that need high data rate bursts in order to prevent pixelization of the picture, such as live sports events will obtain the bandwidth as they need it by reducing the

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data rate for other services that do not. Statistical multiplexing should improve perceived picture quality, especially on video that changes rapidly. It also has the advantage of requiring no changes in the receiver equipment.

MDCT (Modified DCT) – Used in Layer 3 audio coding.

MDS – Multipoint Distribution Service.

Media Conversion – The process of converting data from one type of media to another for mastering and mastering. Mastering software typically requires input data on hard disk.

Median Filter – An averaging technique used by PCEC in its IDTV line interpolation scheme to take an average of lines in the current and previous fields to optimize resolution and avoid motion artifacts without using motion compensation.

Medium – The substance through which a wave is transmitted.

Medium Scale Integration (MSI) – Technology by which a dozen or more gate functions are included on one chip.

Medium Shot – Camera perspective between long shot and closeup, whereby subjects are viewed from medium distance.

Mega – One million, i.e., megacycle is one million cycles.

Megabyte (Mbyte) – One million bytes (actually 1,048,576); one thousand kilobytes.

Megahertz (MHz) – One million hertz (unit of frequency). A normal U.S. television transmission channel is 6 MHz. The base bandwidth of the video signal in that channel is 4.2 MHz. The SMPTE HDEP system calls for 30 MHz each for red, green, and blue channels.

Memory – Part of a computer system into which information can be inserted and held for future use. Storage and memory are interchangeable terms. Digital memories accept and hold binary numbers only. Common memory types are core, disk, tape, and semiconductors (which includes ROM and RAM).

Memory Counter (or Rewind) – A system which allows the tape to be rewound automatically to any predetermined point on the tape.

Memory Effect – Loss of power storing capability in NiCad (video camera) batteries which occurs when batteries are habitually discharged only partially before recharging. To avoid the memory effect, always fully discharge NiCad batteries before recharging.

Memory Map – Shows the address assignments for each device in the system.

Memory-Mapped I/O – I/O devices that are accessed by using the same group of instruction and control signals used for the memory devices in a system. The memory and I/O devices share the same address space.

Menu – **a)** A list of operations or commands that the IRIS can carry out on various objects on the screen. **b)** A group of parameters and flags that enable manipulation of the video image. Menus are Target, Rotate, Border, Source (with Sides submenu), Digimatte, Timeline, and KF Flags. **c)** A graphic image, either still or moving, with or without audio provided to offer the user a variety of choices within the confines of the authoring and prod-

uct material provided. It is the traditional meaning of a menu like you might find in a restaurant.

MER – Modulation Error Ratio.

MESECAM – Middle East SECAM or (B, G, D, K) SECAM.

Meshbeat – See Moiré.

Metadata – **a)** The descriptive and supporting data that is connected to the program or the program elements. It is intended to both aid the direct use of program content and support the retrieval of content as needed during the post-production process. **b)** Generally referred to as “data about data” or “data describing other data.” More specifically, information that is considered ancillary to or otherwise directly complementary to the essence. Any information that a content provider considers useful or of value when associated with the essence being provided.

Metadata Dictionary – The standard database of approved, registered data element tags, their definitions and their allowed formats.

Metal Particle – One of the most recent developments of a magnetizable particle for magnetic tape, products from pure iron and having very high coercivity in the range of 850 to 1250 oersteds.

Metamorphosis – Given two databases with the same number of vertices, a metamorphosis causes the first to become the second. This is an animation tool.

Mezzanine Compression – Contribution level quality encoded high definition television signals. Typically split into two levels: high level at approximately 140 Mbps and low level at approximately 39 Mbps (for high definition with the studio, 270 Mbps is being considered). These levels of compression are necessary for signal routing and are easily re-encoded without additional compression artifacts (concatenation) to allow for picture manipulation after decoding. DS-3 at 44.736 will be used in both terrestrial and satellite program distribution.

MGT – Master Guide Table.

MHEG – See Multimedia Hypermedia Expert Group.

MHz – Megahertz.

MIB – Management Information Base.

Micro – One millionth.

Micro-Cassette – A miniature cassette system originated by Olympus, allowing 30 minutes of recording per side on a capstan-driven tape, 1/7" wide, running at 15/16 ips.

Microcode – See Microprogram.

Microcomputer – Complete system, including CPU, memory and I/O interfaces.

Microdropouts – Low level, short duration dropouts. They correspond to RF envelope dropouts of 10 dB or greater with a duration of 0.5 to 0.8 microseconds.

Microphone – A transducer which converts sound pressure waves into electrical signals.

Microphone Impedance – In order to obtain the highest quality output signal from a microphone, a preamplifier input should provide a load

(impedance) which exactly matches a microphone's output impedance. Microphone output impedances vary from 150 ohms to several megohms.

Microphone Preamplifier – A microphone is a transducer which converts sound waves to electrical impulses. Microphones typically generate very low signal levels requiring low noise, high fidelity, pre-amplification to boost the output signal to a level compatible with audio amplifier circuitry. Good microphone preamplifiers provide precise matching of microphone impedance and low-noise electronic components.

Microphonics – In video transmission, refers to the mechanical vibration of the elements of an electron tube resulting in a spurious modulation of the normal signal. This usually results in erratically spaced horizontal bars in the picture.

Microprocessor – Central processing unit fabricated on one or two chips. The processor consists of the arithmetic and logic unit, control block, and registers.

Microprogram – Program that defines the instruction set. The microprogram (also called microcode) tells the CPU what to do to execute each machine language instruction. It is even more detailed than machine language and is not generally accessible to the user.

Microsecond – One millionth of a second: 1×10^{-6} or 0.000001 second. A term used to mean very fast/instantaneous.

Microwave Dish – A parabolic shaped antenna used for high-frequency RF signals.

Microwave Transmission – Communication systems using high-frequency RF to carry the signal information.

Microwaves – Radio frequencies with very short wavelengths (UHF).

MII – Portable, professional video component camera/recorder format, using 1/2" metal particle videotape.

MII (M2) – Second generation camera/recorder system developed by Panasonic. Also used for just the recorder or the interconnect format. MII uses a version of the (Y, R-Y, B-Y) component set.

MII Format – See the MII discussion.

Mike – Microphone.

Mike Boom – A rigid extension to which a microphone may be attached.

Mike Pad – An attenuator placed between the output of a mike and the input of a mike preamp to prevent overdriving the preamp.

Mil – 0.001 of an inch.

Miller Squared Coding (M₂) – A DC-free channel coding scheme used in D2 VTRs.

Millimeter – One thousandth of a meter.

Millimicron – One billionth of a meter.

Millisecond – One thousandth of a second.

MIME – Multi-Purpose Internet Mail Extensions.

Mini-Cassette – A miniature cassette system originated by Philips, allowing 15 minutes of recording per side on a narrow tape.

Minimize – To reduce a window to an icon for later use.

Minimum Performance – The line between EDTV and HDTV. Naturally, each ATV proponent defines minimum performance so as to favor its system to the detriment of others.

MIP – Mega-Frame Initialization Packet.

MIT (Massachusetts Institute of Technology) – Home of the Media Lab and its Advanced Television Research Program (ATRP), its Audience Research Facility, its Movies of the Future program, and other advanced imaging and entertainment technology research. In addition to conducting and publishing a great deal of ATV research, MIT has come up with two ATV proposals of its own, one called the Bandwidth Efficient Proposal and one the Receiver Compatible Proposal.

Mix – a) A transition between two video signals in which one signal is faded down as the other is faded up. Also called a dissolve or cross fade.

b) This term is most often used as a synonym for additive mix but may also refer to a non-additive mix.

Mix Effects (M/E) – One of the console modules (or its associated signal processing boards) which allows an operator to perform wipes, mixes, keys, etc.

Mixer – The audio or video control equipment used for mixing sound and/or video. In video, a device for combining several video input signals.

Mixing – To combine various pictures and/or audio elements together.

Mixing Console – A device which can combine several signals into one or more composite signals, in any desired proportion.

Mixing, Digital – A step in post-production during which two or more digital representations are combined to create an edited composition. In a transmission, recording, or reproducing system, combining two or more inputs into a common output, which operates to combine linearly the separate input signals in a desired proportion in an output signal. **Production:** Generally the editing of digital image data, resulting in composites ranging from simple transitions to multilayered collages combining selected information from many interim images. The combining of digital images is accomplished by suitable arithmetic calculations on related pairs of digital words. **Data Processing:** A process of intermingling of data traffic flowing between concentration and expansion stages.

MJD – Modified Julian Date.

MJPEG – See Motion JPEG.

MMCD (Multimedia CD) – A development proposal from Sony and Philips, now integrated in the DVD.

MMDS (Multi-Point Microwave Distribution System) – A terrestrial broadcasting technology which uses low-power microwave transmitters, and is mainly used for extending the range of cable TV systems and for TV distribution in sparsely populated areas or in areas with rough terrain. MMDS is not specifically analog or digital. In digital MMDS, the use of MPEG is highly attractive to boost the number of channels that may be distributed.

MMI – Man Machine Interface.

Mnemonic Code – Codes designed to assist the human memory. The microprocessor language consists of binary words, which are a series of 0s and 1s, making it difficult for the programmer to remember the instructions

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corresponding to a given operation. To assist the human memory, the binary numbered codes are assigned groups of letters (of mnemonic symbols) that suggest the definition of the instruction. For example, the 8085 code 100000 binary means load accumulator and is represented by the mnemonic LDA.

Mobile Unit – Equipment designed to be movable as a unit. A truck/van with all the necessary equipment to do photography/production on location. Sometimes mobile units have cameras and VTRs within them and sometimes they are added for specific jobs.

Mod – Abbreviation for Modulator on the 4100 series and Modifier on the AVC series.

Model-Based Coder – Communicating a higher-level model of the image than pixels is an active area of research. The idea is to have the transmitter and receiver agree on the basic model for the image; the transmitter then sends parameters to manipulate this model in lieu of picture elements themselves. Model-based decoders are similar to computer graphics rendering programs. The model-based coder trades generality for extreme efficiency in its restricted domain. Better rendering and extending of the domain are research themes.

Modeling – a) The process of creating a 3D world. There are several kinds of 3D modeling, including: boundary representation, parametric (or analytic), and constructive solid geometry. After the geometry of a model is determined, its surface properties can be defined. **b)** This process involves describing the geometry of objects using a 3D design program.

Modem (Modulator/Demodulator) – An electronic device for converting between serial data (typically RS-232) from a computer and an audio signal suitable for transmission over telephone lines. The audio signal is usually composed of silence (no data) or one of two frequencies representing 0 and 1. Modems are distinguished primarily by the baud rates they support which can range from 75 baud up to 56000 and beyond. Various data compression and error algorithms are required to support the highest speeds. Other optional features are auto-dial (auto-call) and auto-answer which allow the computer to initiate and accept calls without human intervention.

Modifier – Pattern system electronics capable of modulator effects, continuous rotation effects, pattern border hue modulation, pattern border rainbows, and position modulation.

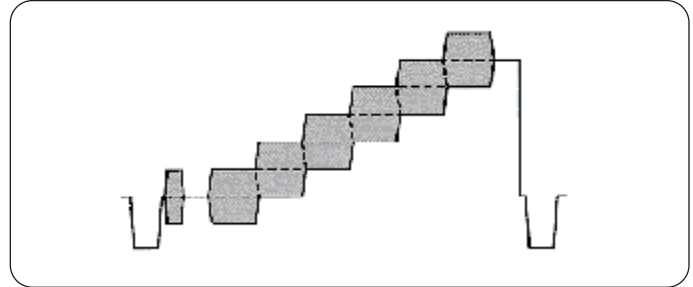
Modulate – To impress information on an AC or RF signal by varying the signals amplitude, frequency, or phase.

Modulated – When referring to television test signals, this term implies that chrominance, luminance, sync, color burst, and perhaps audio information is present.

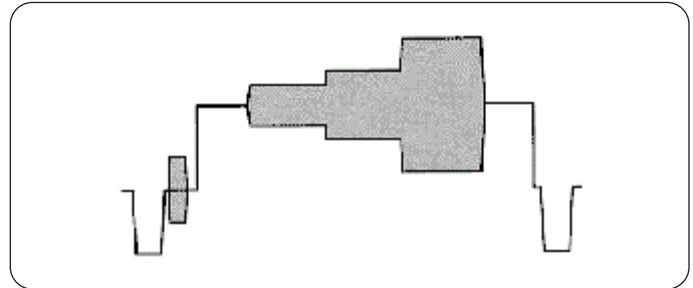
Modulated Carrier Recording – Signal information recorded in the form of a modulated carrier.

Modulated Five Step Test Signal – A test signal with five steps of luminance change, each step having a constant frequency and phase chromi-

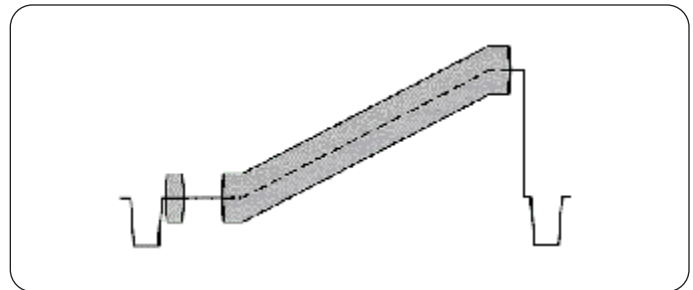
nance signal. This signal is used to test for Differential Phase distortions. There is also a 10 step version of this signal.



Modulated Pedestal – A test signal which consists of three chrominance packets with the same phase, on the same luminance level (50 IRE), with different amplitudes (20, 40, and 80 IRE). This signal is used to test for chrominance nonlinear phase distortion and chrominance to luminance intermodulation distortion.



Modulated Ramp Test Signal – A test signal with a linear rise in luminance and constant chrominance as shown in the figure below. This signal is used to test for Differential Phase distortions.



Modulation – a) The imposing of a signal on some type of transmission or storage medium, such as a radio carrier or magnetic tape. **b)** The process (or result) of changing information (audio, video, data, etc.) into information-carrying signals suitable for transmission and/or recording. In NTSC-M television transmission, video is modulated onto a picture carrier using amplitude modulation-virtual sideband, and audio is modulated onto a sound carrier using frequency modulation.

Modulation Noise – a) Noise which results from the agitation of the oxide molecules through the recording process. The modulation noise level increases as record level increases and disappears when no signal is pres-

ent. **b)** The noise arising when reproducing a tape which has been recorded with a given signal, and which is a function of the instantaneous amplitude of the signal. This is related to DC noise and arises from the same causes.

Modulator – a) A section within a VTR that changes the frequency of the video signal information coming in from an external source (i.e., an electronic camera) to signal information that is compatible with the requirements of the VTR heads, while keeping the picture information basically unchanged. **b)** Pattern system electronics capable of distorting the edge of a pattern by impressing a sine or other waveform on the vertical or horizontal shape of the pattern. **c)** The device that places information on an RF carrier signal.

Modulator Lock – A feature that synchronizes the modulator or modifier effect to the frame rate, thus preventing the effect from drifting or appearing incoherent.

Module – A small device, not working by itself, designed to perform specialized tasks in association with a host, for example: a conditional access subsystem, an electronic program guide application module, or to provide resources required by an application but not provided directly by the host.

Moiré – a) An image artifact that occurs when a pattern is created on the screen where there should not be one. The moiré pattern is generated when different frequencies that are part of the video signal, create a new unwanted frequency. **b)** A wavy pattern, usually caused by interference. When that interference is cross-color, the pattern is colored, even if the picture is not. **c)** The spurious pattern in the reproduced television picture resulting from interference beats between two sets of periodic structures in the image. It usually appears as a curving of the lines in the horizontal wedges of the test pattern and is most pronounced near the center where the lines forming the wedges converge. A Moiré pattern is a natural optical effect when converging lines in the picture are nearly parallel to the scanning lines.

MOL (Maximum Output Level) – In audio tape, that record level which produces a 3rd harmonic distortion component at 3.0%.

Mole Technology – A seamless MPEG-2 concatenation technology developed by the ATLANTIC project in which an MPEG-2 bitstream enters a Mole-equipped decoder, and the decoder not only decodes the video, but the information on how that video was first encoded (motion vectors and coding mode decisions). This “side information” or “metadata” in an information bus is synchronized to the video and sent to the Mole-equipped encoder. The encoder looks at the metadata and knows exactly how to encode the video. The video is encoded in exactly the same way (so theoretically it has only been encoded once) and maintains quality. If an opaque bug is inserted in the picture, the encoder only has to decide how the bug should be encoded (and then both the bug and the video have been theoretically encoded only once). Problems arise with transparent or translucent bugs, because the video underneath the bug must be encoded, and therefore that video will have to be encoded twice, while the surrounding video and the bug itself have only been encoded once theoretically. What Mole cannot do is make the encoding any better. Therefore, the highest quality of initial encoding is suggested.

Moment of Inertia – A measure of the rotational force required to accelerate or decelerate a reel of tape or other rotating object.

Monitor – a) A TV set, or a TV set specifically designed for closed circuit viewing (i.e., from a VTR) without the electronic capability to receive broadcast signals. **b)** A hardware device that displays the images, windows, and text with which you interact to use the system. It is also called a video display terminal (VDT). **c)** Program that controls the operation of a microcomputer system and allows user to run programs, examine and modify memory, etc.

Monitor Head – A separate playback head on some tape recorders that makes it possible to listen to the material on the tape an instant after it has been recorded and while the recording is still in progress.

Monitor Outputs – A set of outputs from a switcher or video recorder for the specific purpose of feeding video monitors (although not limited to that purpose). These include preview, individual M/Es, DSK, and bus rows. The AVC also provides monitor outputs for RGB signals, aux bus selections, and switcher status information.

Monitor Power Cable – The cable that connects the monitor to the workstation to provide power to the monitor. It has a male connector on one end and a female connector on the other.

Monitor Standardization – Although it is customary to make all subjective judgments of image quality from the reference monitor display, the infinite possibilities for monitor adjustments have hampered reviewers in exercising effective program control, and have introduced many disparities and great confusion. The SMPTE Working Group on Studio Monitors, S17.28, is completing work on three specifications intended to make the monitor display follow a known electro-optic transfer function and permit a reliable evaluation of the program image quality.

Monitor Video Cable – The cable that connects the monitor to the workstation to transmit video signals. It has large connector on both ends.

Monitor, Control – A control monitor is one employed primarily for decisions on subject matter, composition, and sequences to be selected in real-time. It is frequently one of several monitors mounted together in close proximity as in a studio – for example, to display multiple sources that are to be compared, selected, and combined in editing for immediate, direct routing to display. The physical arrangements may make it very difficult to control the surroundings for each monitor, as specified by SMPTE Working Group on Studio Monitors in Document S17.280 for the reference monitor. It is nevertheless essential when sequences on several monitors are being compared and intercut that the monitors match in luminance and colorimetry.

Monitor, Reference – A reference monitor is one employed for decisions on image quality. Achieving controlled reproducibility for this application is the primary objective of the specifications for monitor standardization. SMPTE Working Group on Studio Monitors, S17.28, has recognized the great disparity now existing among studio monitors and control monitors, and has noted the confusing variability among decisions based upon visual judgments of program quality as evaluated on different monitors. They are working to identify and recommend specifications for the variables affecting subjective judgments, coming not only from the monitor capabilities,

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but also from the adjustment of its controls and the bias introduced by monitor surround and room illumination.

Monitor, Standardization – Although it is customary to make all subjective judgments of image quality from the reference monitor display, the infinite possibilities for monitor adjustments have hampered reviewers in exercising effective program control, and have introduced many disparities and great confusion. The SMPTE Working Group on Studio Monitors, S17.27, is completing work on three specifications intended to make the monitor display follow a known transfer function, electro-optic, and permit a reliable evaluation of the program image quality.

Mono, Monophonic – Single-channel sound.

Monochrome – Literally single color, usually used to indicate black and white. There have been monochrome high line rate cameras and displays for many years. The EIA has standardized rates of up to 1225 scanning lines per frame. NHK developed a monochrome HDTV system with 2125 scanning lines per frame. Even higher number of scanning lines are used in conjunction with lower frame rates in cathode ray tube scanners used in printing and in film. These extremely high rates are possible because monochrome picture tubes have no triads.

Monochrome Signal – A “single color” video signal – usually a black and white signal but sometimes the luminance portion of a composite or component color signal.

Monochrome Transmission (Black and White) – The transmission of a signal wave which represents the brightness values in the picture but not the color (chrominance) values in the picture.

Monophonic – One sound channel/source/signal. Sometimes called monaural.

MooV – The file format used in the QuickTime and QuickTime for Windows environments for displaying videos. See QuickTime, QuickTime for Windows.

Morphing – A technique for making an object change into the shape of another.

MOS (Metal Oxide Semiconductor) – Integrated circuits made of field effect transistors. All MOS devices originally used metal gate technology, but the term is used to describe silicon gate circuits as well.

Mosaic – Term used for an ADO effect which is to segmentize a video signal into rectangles of variable block sizes and aspect ratio.

Mosquito Noise – This is caused by quantizing errors between adjacent pixels, as a result of compression. As the scene content varies, quantizing step sizes change, and the quantizing errors produced manifest themselves as shimmering black dots, which look like “mosquitoes” and that show at random around objects within a scene.

Most Significant Bit (MSB) – The bit that has the most value in a binary number or data byte. In written form, this would be the bit on the left. For example:

Binary 1110 = Decimal 14

In this example, the leftmost binary digit, 1, is the most significant bit, here representing 8. If the MSB in this example were corrupt, the decimal would not be 14 but 6.

Motherboard – See Backplane.

Motion Adaptive – An ATV scheme that senses motion and changes the way it functions to avoid or reduce motion artifacts.

Motion Artifacts – **a)** Picture defects that appear only when there is motion in the scene. Interlaced scanning has motion artifacts in both the vertical and horizontal directions. There is a halving of vertical resolution at certain rates of vertical motion (when the detail in one field appears in the position of the next field one sixtieth of a second later), and horizontally moving vertical edges become segmented (reduced in resolution) by the sequential fields. This is most apparent when a frame of a motion sequence is frozen and the two fields flash different information. All sub-sampling ATV schemes have some form of motion artifact, from twinkling detail to dramatic differences between static and dynamic resolutions. Line doubling schemes and advanced encoders and decoders can have motion artifacts, depending on how they are implemented. Techniques for avoiding motion artifacts include median filtering and motion adaptation or compensation. **b)** In all temporally-sampled systems (i.e., both photographic and electronic), realistic motion reproduction is achieved only with sampling above the Nyquist limit. The subjective response to motion artifacts is complex, influenced by the various degrees of smoothing and strobing affecting temporal and spatial resolution, integration and lag in the sensing, recording, and display elements; sampling geometry and scanning patterns; shutter transmission ratio; perceptual tolerances, etc. (Motion appears “normal” only when significant frame-to-frame displacement occurs at less than half the frame rate; i.e., “significant motion” distributed over at least two frames.) Motion artifacts most frequently observed have their origins in the following: image components with velocity functions extending beyond the Nyquist limit (such as rotating, spoked wheels), motion samples with such short exposures there is noticeable frame-to-frame separation of sharply defined images (such as synchronized flash illumination), asynchronous sampling of intermittent motion (such as frame-rate conversions). A considerable number of motion artifacts appear so frequently as to be accepted by most viewers.

Motion Compensation – In MPEG, the use of motion vectors to improve the efficiency of the prediction of pel values. The prediction uses motion vectors to provide offsets into the past and/or future reference pictures containing previously decoded pel values that are used to form the prediction error signal. The book *Motion analysis for Image Sequence Coding* by G. Tziritas and C. Labit documents the technical advances made through the years in dealing with motion in image sequences.

Motion Estimation – The process of determining changes in video object positions from one video frame to the next. Object position determination is used extensively in high-compression applications. For instance if the background of a scene does not change but the position of an object in the foreground does, it is advantageous to just transmit the new position of the object rather than the background or foreground. This technology is used in MPEG, H.261, and H.263 compression.

Motion JPEG – Applications where JPEG compression or decompression is speeded up to be able to process 25 or 30 frames per second and is applied real-time to video. Even though a video signal is being processed, each field is still individually processed.

Motion Path – The movement between keyframes, changed with the Path soft key. There are five types of paths. **BRK** (Break) modifies Smooth motion by decelerating speed to zero at each keyframe (a break), then starting again. **IGN** (Ignore) allows selected parameter values to be ignored when calculating motion path. **SMT** (Smooth) provides a curved path between keyframes. The effect speeds up gradually as it leaves the first keyframe, and slows down gradually until it reached the last keyframe. **LIN** (Linear) provides a constant rate of change between keyframes, with an abrupt change at each keyframe. Linear uses the shortest distance between two points to travel from one keyframe to another. **HOLD** stops all motion between keyframes. The result of the motion shows when the next keyframe appears. HOLD looks like a video “cut,” from one keyframe to the next.

Motion Path Velocity – A successful motion path has two components: geometry and timing. The geometry is created by choosing keyframes. The timing of the path is more complex, and can be affected by the geometry. Intuitively, the timing of a path is simply the speed of motion of the object as it moves along the path. Since PictureMaker starts with keyframes and creates in-between positions, PictureMaker determines the velocity by deciding how many in-betweens to place between each keyframe (and where to place them). Several methods can be used to determine velocity along the path. **a)** Place frame evenly between all keyframes. Closely placed keyframes will correspond with slow moving parts of the path. **b)** Specify a relative velocity at selected keyframes, and specify correspondences between any keyframe and a frame in the final animation.

Motion Resolution – See Dynamic Resolution.

Motion Surprise – A major shift in the quality of a television picture in the presence of motion that is so jarring to the viewer that the system might actually appear better if it had continuously lower quality, rather than jumping from high-quality static image to a lower quality dynamic one.

Motion Vector – **a)** A two-dimensional vector used for motion compensation that provides an offset from the coordinate position in the current picture to the coordinates in a reference picture. **b)** A pair of numbers which represent the vertical and horizontal displacement of a region of a reference picture for production.

Mount – To make a file system that is stored on a local or remote disk resource accessible from a specific directory on a workstation.

Mount Point – The directory on a workstation from which you access information that is stored on a local or remote disk resource.

Mouse – A hardware device that you use to communicate with windows and icons. You move the mouse to move the cursor on the screen, and you press its buttons to initiate operations.

Mouse Pad – For an optical mouse, this is the rectangular, metallic surface that reads the movements of the mouse. For a mechanical mouse, this is a clean, soft rectangular surface that makes the mouse’s track ball roll efficiently.

MOV – The file extension used by MooV format files on Windows. See MooV.

Moving Dots – See Chroma Crawl.

Moving Picture Experts Group (MPEG) – An international group of industry experts set up to standardize compressed moving pictures and audio. The first release of the MPEG standard was called MPEG-1.

Moving Picture Experts Group 1 (MPEG-1) – ISO/IEC CD 11172 is the first of the standards designed for handling highly compressed moving images in real-time. It accepts periodically chosen frames to be compressed as in JPEG-1, predicts the content of intervening frames, and encodes only the difference between the actual and the prediction. Audio is compressed synchronously. The encoder includes a decoder section in order to generate and verify the predictions. At the display, a much simpler decoder becomes possible. MPEG-1 is optimized for a data rate of up to 1.5 Mb/s. MPEG expects to develop a series of compression codes, optimized for higher bit rates.

Moving Picture Experts Group 2 (MPEG-2) – MPEG-2 expands the MPEG-1 standard to cover a wider range of applications.

Moving Picture Experts Group 3 (MPEG-3) – MPEG 3 was originally intended for HDTV applications but has since been incorporated into MPEG-2.

Moving Picture Experts Group 4 (MPEG-4) – The goal of MPEG-4 is to establish a universal and efficient coding for different forms of audio-visual data, called audio-visual objects. Coding tools for audio-visual objects are being developed to support various functionalities, such as object-based interactivity and scalability. The syntax of the audio-visual objects is being developed to allow for description of coded objects and to describe how they were coded. This information can then be down loaded into a decoder. MPEG-4 is expected to be available by the year 2000.

Moving-Coil – A microphone whose generating element is a coil which moves within a magnetic gap in response to sound pressure on the diaphragm attached to it, rather like a small loudspeaker in reverse. The most common type of Dynamic Microphone.

MP – Multi-Link Point-to-Point Protocol.

MP3 – A commonly used term for the MPEG-1 Layer 3 (ISO/IEC 11172-3) or MPEG-2 Layer 3 (ISO/IEC 13818-3) audio compression formats. MPEG-1 Layer 3 is up to two channels of audio and MPEG-2 Layer 3 is up to 5.1 channels of audio. MP3 is not the same as MPEG-3.

MP@HL (Main Profile at High Level) – Widely used shorthand notation for a specific quality and resolution of MPEG: Main Profile (4:2:0 quality), High Level (HD resolution).

MP@ML – Main Profile at Main Level.

MPCD (Minimum Perceptible Color Difference) – A unit of measure, developed by the CIE, to define the change in light and color required to be just noticeable to the human eye. The human being in this MPCD unit is defined as “a trained observer” because there are differences in the way each of us perceive light.

MPEG – A standard for compressing moving pictures. MPEG uses the similarity between frames to create a sequence of I, B, and P frames. Only the I frame contains all the picture data. The B and P frames only contain information relating to changes since the last I frame. MPEG-1 uses a data rate of 1.2 Mbps, the speed of CD-ROM. MPEG-2 supports much higher quality with a data rate (also called bit rate) of from 1.2 to 15 Mbps. MPEG-2 is

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the format most favored for video on demand, DVD, and is the format for transmitting digital television.

MPEG-1 – See Moving Picture Experts Group 1.

MPEG-2 – See Moving Picture Experts Group 2.

MPEG-3 – See Moving Picture Experts Group 3.

MPEG-4 – See Moving Picture Experts Group 4.

MPEG 4:2:2 – Also referred to as Studio MPEG, Professional MPEG, and 442P@ML. Sony's Betacam SX is based on MPEG 4:2:2.

MPEG-7 – MPEG-7 is a multimedia content (images, graphics, 3D models, audio, speech, video) representation standard for information searching. Final specification is expected in the year 2000.

MPEG Splicing – The ability to cut into an MPEG bitstream for switching and editing, regardless of frame types (I, B, P).

MPEG TS – MPEG Transport Stream.

MPI – MPEG Physical Interface.

MPTS – Multi-Port Presentation Time Stamps.

MPP (Mix to Preset Pattern) – See Preset Pattern.

MPU (Microprocessing Unit) – See Microprocessor.

MSB – Most Significant Bit.

MSDL – MPEG-4 Syntactic Description Language.

MSI – Medium Scale Integration.

MSO – Multiple Cable System Operator.

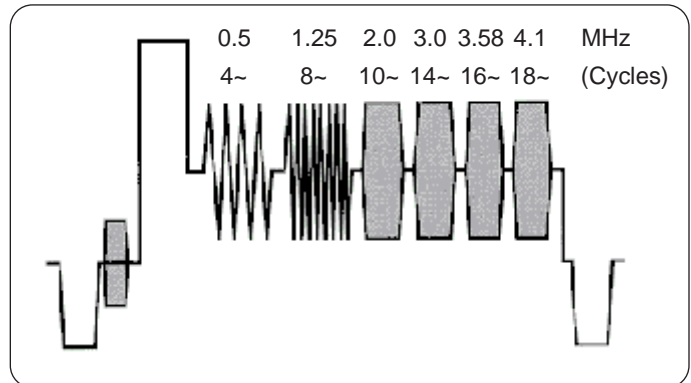
MTBF – Mean Time Between Failures.

MTS – Used in conjunction with NTSC/525. Consists of two independent carriers each carrying a discrete channel. One channel provides stereo sound by providing left/right channel difference signals relative to transmitted mono audio track. The second carrier carries the Secondary Audio Program (SAP) which is used for a second language or a descriptive commentary for the blind. Uses a technique based on the dBx noise reduction to improve the frequency response of the audio channel.

MTTR – Mean Time to Repair.

MTU – Multi-Port Transceiver Unit.

Multiburst – The multiburst waveform is shown in the figure below. This signal is useful for quick approximations of the system's frequency response and can be used as an in-service VIT signal.



MultiCrypt – Used to describe the simultaneous operation of several conditional access systems.

Multifrequency Monitor – A monitor that accommodates a variety of horizontal and vertical synchronization frequencies. This monitor type accepts inputs from many different display adapters, and is typically capable of either analog or digital input.

Multi-Language Support – A DVD has the ability to store eight audio streams. This is different than the number of channels each stream might have. Thus, each of the streams might contain a multi-channel audio program in a separate language.

Multi-Layer Effects – A generic term for a mix/effects system that allows multiple video images to be combined into a composite image.

Multimedia – A somewhat ambiguous term that describes the ability to combine audio, video, and other information with graphics, control, storage, and other features of computer-based systems. Applications include presentation, editing, interactive learning, games, and conferencing. Current multimedia systems also use mass storage computer devices such as CD-ROM.

Multimedia Hypermedia Expert Group (MHEG) – MHEG is another working group under the same ISO/IEC subcommittee that feature the MPEG. The MHEG is the Working Group 12 (WG 12) of Subcommittee 29 (SC 29) of the joint ISO and IEC Technical Committee 1 (JTC 1). The ISO/IEC standards produced have number 13522. MHEG targets coding of multimedia and hypermedia information, and defines an interchange format for composite multimedia contents. The defined MHEG format encapsulates a multimedia document, so to speak, as communication takes place in a specific data structure. Despite the talk about multimedia, there is not very much said and written about MHEG, which seems odd given the realm of MHEG. The present market significance of MHEG is very low, probably due to the high number of proprietary standards for audio visual representation in multimedia PC environments.

Multipath Distortion – A form of interference caused by signal reflections. Signals that are reflected more take a longer path to reach the receiver than those that are reflected less. The receiver will synchronize to

the strongest signal, with the weaker signals traveling via different paths causing ghostly images superimposed on the main image. Since many ATV schemes offer increased horizontal resolution, ghosts can have a more deleterious effect on them than on ordinary NTSC signals. There have been many demonstrations of ghost canceling/eliminating systems and robust transmission systems over the years. It is probable that these will have to be used for HDTV.

Multiplane Animation – Multiplane animation refers to a type of cel animation where individual cels are superimposed using the painters algorithm, and their motion relative to each other is controlled. Here, the word “plane” and cel are interchangeable.

Multiple Blanking Lines – Evidenced by a thickening of the blanking line trace or by several distinct blanking lines as viewed on an oscilloscope. May be caused by hum.

Multiple-FIFO Architecture – A display controller architecture characterized by having multiple FIFOs or write buffers. There is typically one FIFO or write buffer at the CPU interface, and one or more FIFOs in the display pipeline.

Multiplex – **a)** To take, or be capable of taking, several different signals and send them through one source. **b)** To combine multiple signals, usually in such a way that they can be separated again later. There are three major multiplexing techniques. Frequency division multiple (FDM) assigns each signal a different frequency. This is how radio and television stations in the same metropolitan area can all transmit through the same air space and be individually tuned in. Time division multiple (TDM) assigns different signals different time slots. Different programs can be broadcast over the same channel using this technique. More technically, the MADs use TDM for luminance and chrominance. Space or path division multiplex allows different television stations in different cities to use the same channel at the same time or different people to talk on different telephones in the same building at the same time. **c)** A stream of all the digital data carrying one or more services within a single physical channel. **d)** To transmit two or more signals at the same time or on the same carrier frequency. **e)** To combine two or more electrical signals into a single, composite signal.

Multiplexed Analog Component – See MAC.

Multiplexer (MUX) – Device for combining two or more electrical signals into a single, composite signal.

Multiplexing – Process of transmitting more than one signal via a single link. The most common technique used in microprocessor systems is time-division multiplexing, in which one signal line is used for different information at different times.

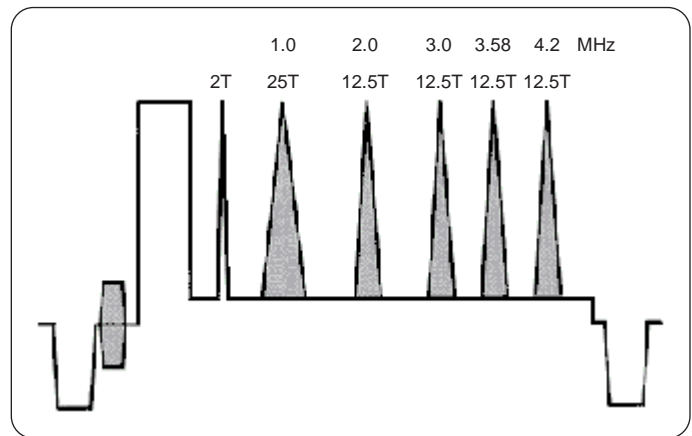
Multiplexer – A control circuit in which a non-video control signal is faded down as the other is faded up.

Multipoint Control Unit (MCU) – A switching device commonly used to switch and control a videoconferencing network allowing multiple sites to conference simultaneously.

Multiprotocol Encapsulation – The data broadcast specification profile for multiprotocol encapsulation supports data broadcast services that require the transmission of datagrams of communication protocols via DVB compliant broadcast networks. The transmission of datagrams according to

the multiprotocol encapsulation specification is done by encapsulating the datagrams in DSM-CC sections, which are compliant with the MPEG-2 private sector format.

Multipulse – This signal is a variation of the sine-squared pulses. Multipulse allows for the simultaneous evaluation of group-delay errors and amplitude errors at the various frequencies. Distortions show up in multipulse as distortions of the baseline as was seen in the Chrominance to Luminance Gain and Delay measurements or the Group Delay measurement. Refer to the figure and to the Sine-Squared pulse discussion.



Multi-Scan Monitor – A monitor (also referred to as multi-sync or multi-frequency) which can synchronize to different video signal sync frequencies, allowing its use with various computer video outputs. See Analog Monitor.

Multi-Standard – TV sets, VTRs, etc., that are designed to work using more than one technical standard; i.e., a VTR which can record both NTSC and PAL signals/recordings is a multi-standard machine.

Multitrack Tape – A piece of magnetic tape which can be used to store two or more discrete signals.

Munsell Chroma – **a) Illuminating Engineering:** The index of perceived (Y) and chromaticity coordinates (x,y) for CIE Standard Illuminance C and the CIE Standard Observer. **b) Television:** The dimension of the Munsell system of color that corresponds most closely to saturation. Note: Chroma is frequently used, particularly in English works, as the equivalent of saturation.

Munsell Color System – A system of surface-color specifications based on perceptually uniform color scales for the three variables. Munsell hue, Munsell value, and Munsell chroma. For an observer of normal color vision, adapted to daylight and viewing the specimen when illuminated by daylight and surrounded with a middle gray to white background, the Munsell hue, value, and chroma of the color correlate well with the hue, lightness, and perceived chroma.

MUSE (Multiple Sub-Nyquist Sampling Encoding) – **a.** 16:9 aspect ratio, high definition, widescreen television being proposed in Japan. **b)** A term originally used for a transmission scheme developed by NHK specifically for DBS transmission of HDTV. MUSE has since been extended to a

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family of ATV transmission schemes. MUSE, as it was originally developed, is a form of MAC. Recent versions of MUSE (MUSE- and MUSE-9) are said to be receiver-compatible and, as such, cannot employ MAC techniques. The sub-Nyquist part of the name indicates that MUSE is a sub-sampling system and, as such, is subject to motion artifacts. While it is one of the oldest ATV transmission schemes still considered viable, MUSE is only four years old.

MUSE-6 – A family of three versions of an ATV transmission scheme said to be both receiver-compatible and channel-compatible. Since the original MUSE schemes are neither, there is little similarity between them, other than the use of sub-sampling. The differences between the three versions relate to how the wide aspect ratio is handled and what techniques are used for augmentation in an ATV set. Two versions of MUSE-6 use the letterbox technique for aspect ratio accommodation and both of these use blanking stuffing in the expanded VBI area for vertical resolution enhancement. The differences between the two versions relate to the duration of the sub-sampling sequence (one frame or two). The third uses the truncation technique for aspect ratio accommodation, sending the side panels stuffed into the existing VBI and HBI. Additional horizontal detail is transmitted via two-frame sub-sampling.

MUSE-9 – A family of three versions of an ATV transmission scheme said to be receiver-compatible and using a 3 MHz augmentation channel. The three versions are very similar to the three versions of MUSE-6, except that the version using the truncation method sends the wide-screen panels on the augmentation channel rather than stuffing them into the HBI and the VBI. There are two classes of the three versions of MUSE-9, one with a contiguous augmentation channel and one without. The one without is said to be somewhat inferior in quality to the one with.

MUSE-E – MUSE optimized for emission (i.e., broadcasting) rather than transmission (i.e., satellite distribution). It is a non-receiver-compatible, non-channel-compatible scheme occupying 8.1 MHz of base bandwidth and requiring four fields to build up a full-resolution picture. Thus, it

requires motion compensation (and retains some motion artifacts). It offers four channels of high-quality digital audio. It has been tested in the Washington, DC area.

MUSE-II – See MUSE-E.

MUSE-T – MUSE optimized for transmission (via satellite) rather than emission (via terrestrial broadcasting). It occupies twice the bandwidth of MUSE-E (16.2 MHz), but is otherwise quite similar.

Music and Effects Track(s) – Music and effects audio without video. Can be on one track, on different tracks on one piece of film or tape, or on different tapes, which are combined during an audio “track mix” session. Sometimes abbreviated M&E.

MUSICAM (Masking Pattern Adapted Universal Sub-Band Integrated Coding and Multiplexing) – Compression method for audio coding.

Must Carry – Legal requirement that cable operators carry local broadcast signals. Cable systems with 12 or fewer channels must carry at least three broadcast signals; systems with 12 or more channels must carry up to one-third of their capacity; systems with 300 or fewer subscribers are exempt. The 1992 Cable Act requires broadcast station to waive must-carry rights if it chooses to negotiate retransmission compensation (see Retransmission consent).

MUX – See Multiplexer.

Mux Rate – Defined by MPEG-2 as the combined rate of all video and audio elementary stream packets common to one program. This rate also includes the VBI and sub-picture private stream data, which MPEG treats as a private stream type. Mux rate is always specified as 10.08 mb/s because this is the rate at which user data arrives into the track buffer.

MVDS – Multi-Point Video Distribution System.

Mylar – A registered trademark of E.I. duPont de Nemours & Co., designing their polyester film.

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NAB (National Association of Broadcasters) – An association which has standardized the equalization used in recording and reproducing. This is a station owner and/or operator's trade association. NAB is also a participant in ATV testing and standardization work, and a charter member of ATSC. Though not a proponent of any particular ATV system, NAB lobbies for the interests of broadcasting as a delivery mechanism and has published some of the least biased information on the subject.

NAB Curves, NAB Equalization – Standard playback equalization curves for various tape speeds, developed by the National Association of Broadcasters.

NAB Reel, NAB Hub – Reels and hubs used in professional recording, having a large center hole and usually an outer diameter of 10-1/2".

NABET (National Association of Broadcast Employees and Technicians) – NABET is a union of technicians that supplies members for many videotape, live, and film productions.

NABTS – See North American Broadcast Teletext Specification.

Nagra – A brand of audio tape recorder using 1/4" wide audio tape extensively used for studio and location separate audio recording.

NAM – Non-Additive Mix.

NANBA – North American National Broadcasters Association.

Nanosecond – One billionth of a second: 1×10^{-9} or 0.000000001 second.

NAP (North American Philips) – Philips Laboratories developed the HDS-NA ATV scheme and was among the first to suggest advanced pre-combing. See also PCEC.

Narrow MUSE – An NHK-proposed ATV scheme very similar to MUSE (and potentially able to use the same decoder) but fitting within a single, 6 MHz transmission channel. Unlike MUSE-6 and MUSE-9, narrow MUSE is not receiver-compatible.

Narrowband – Relatively restricted in bandwidth.

Narrowcasting – Broadcasting to a small audience.

National Television System Committee (NTSC) – a) The organization that formulated the "NTSC" system. Usually taken to mean the NTSC color television system itself, or its interconnect standards. NTSC is the television standard currently in use in the United States, Canada, and Japan. NTSC image format is 4:3 aspect ratio, 525 lines, 60 Hz and 4 MHz video bandwidth with a total 6 MHz of video channel width. NTSC uses YIQ. NTSC-1 was set in 1948. It increased the number of scanning lines from 441 to 525, and replaced AM sound with FM. **b)** The name of two standardization groups, the first of which established the 525 scanning-line-per-frame/30 frame-per-second standard and the second of which established the color television system currently used in the United States; also the common name of the NTSC-established color system. NTSC is used throughout North America and Central America, except for the French islands of St. Pierre and Miquelon. It is also used in most of the Caribbean and in parts of South America, Asia, and the Pacific. It is also broadcast at U.S. military

installations throughout the world and at some oil facilities in the Middle East. Barbados was the only country in the world to transmit NTSC color on a non-525-line system; they have since switched to 525 lines. Brazil remains the only 525-line country to transmit color TV that is not NTSC; their system is called PAL-M. M is the CCIR designation for 525-line/30 frame television. See also M.

Native Resolution – The resolution at which the video file was captured.

NAVA (National Audio-Visual Association) – A trade association for audio-visual dealers, manufacturers and producers.

NBC – Television network that was an original proponent of the ACTV ATV schemes. NBC was also the first network to announce its intention to shift from NTSC entirely to CAV recording equipment.

NBC – Non-Backwards Compatible.

NCTA (National Cable Television Association) – The primary cable TV owner and/or operator's trade association. NCTA is performing similar roles to NAB in ATV research and lobbying, with an emphasis on CATV, rather than broadcasting, of course, and is a charter member of ATSC.

NDA – Non-Disclosure Agreement.

NE – Network Element.

Near Instantaneous Companded Audio Multiplex (NICAM) – a) A digital audio coding system originally developed by the BBC for point-to-point links. A later development, NICAM 728 is used in several European countries to provide stereo digital audio to home television receivers. **b)** A digital two-channel audio transmission with sub-code selection of bi-lingual operation. Stereo digital signals with specifications approaching those of compact disc are possible. NICAM uses a 14-bit sample at a 32 kHz sampling rate which produces a data stream of 728 kbits/sec.

Negative Effect – Special effect in which either blacks and whites are reversed or colors are inverted. For example, red becomes a blue-green, green becomes purple, etc. The Video Equalizer and Digital Video Mixer includes a negative effect which can be used to generate electronic color slides from color negatives. An electronic color filter can be used for fine adjustment of the hues.

Negative Image – Refers to a picture signal having a polarity which is opposite to normal polarity and which results in a picture in which the white areas appear as black and vice versa.

Negative Logic – The logic false state is represented by the more positive voltage in the system, and the logic true state is represented by the more negative voltage in the system. For TTL, 0 becomes +2.4 volts or greater, and 1 becomes +0.4 volts or less.

Nested – Subroutine that is called by another subroutine or a loop within a larger loop is said to be nested.

NET (National Educational Television) – A public TV Network of stations.

Network – a) A group of stations connected together for common broadcast or common business purposes; multiple circuits. **b)** A group of computers and other devices (such as printers) that can all communicate with

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each other electronically to transfer and share information. **c)** A collection of MPEG-2 Transport Stream (TS) multiplexes transmitted on a single delivery system, e.g., all digital channels on a specific cable system.

Network Administrator – The individual responsible for setting up, maintaining, and troubleshooting the network, and for supplying setup information to system administrators of each system.

Neutral – Normal; without power; not in working position; without much color or brightness purposes; multiple circuits.

Neutral Colors – The range of gray levels, from black to white, but without color. For neutral areas in the image, the RGB signals will all be equal; in color difference formats, the color difference signals will be zero.

New York Institute of Technology – Private engineering school headquartered in Old Westbury, NY, noted for its advanced computer graphics. Its Science and Technology Research Center, in Dania, FL, has been researching ATV for years. NYIT is a proponent of the VISTA ATV scheme.

NFS™ (Network File System) – A distributed file system developed by Sun that enables a set of computers to cooperatively access each other's files transparently.

NG – An often-used term meaning “no good.”

NHK – See Nippon Hoso Kyokai.

Nibble – Four bits or half a byte. A group of four contiguous bits. A nibble can take any of 16 (2^4) values.

NiCad (Nickel Cadmium) – Common Rechargeable video camera battery type.

NICAM – See Near Instantaneous Companded Audio Multiplexer.

Nippon Hoso Kyokai (NHK) – The Japan Broadcasting Corporation, principal researchers of HDTV through the 1970s, developers of the 1125 scanning-line system for HDEP and of all the MUSE systems for transmission.

Nippon Television – See NTV.

NIST (National Institute of Standards and Technology) – The North American regional forum at which OSI implementation agreements are decided. It is equivalent to EWOS in Europe and AOW in the Pacific.

NIT (Network Information Table) – Information in one transport stream that describes many transport streams. The NIT conveys information relating to the physical organization of the multiplex, transport streams carried via a given network, and the characteristics of the network itself. Transport streams are identified by the combination of an original network ID and a transport stream ID in the NIT.

Nits – The metric unit for brightness. 1 foot lambert = 3.425 nits.

NIU – Network Interface Unit.

NMI (Non-Maskable Interrupt) – A hardware interrupt request to the CPU which cannot be masked internally in the processor by a bit, but must be serviced immediately.

NNI (Nederlands Normalisatie-Instituut) – Standards body in the Netherlands.

Node – **a)** A list of calculations that you can apply to materials as part of the rendering tree language. The node can, in turn, serve as input to other nodes. **b)** Any signal line connected to two or more circuit elements. All logic inputs and outputs electrically connected together are part of the same node.

Nodules – Clusters of materials, i.e., a large nodule of iron oxide on magnetic tape would be a tape defect.

Noise – Any unwanted electrical disturbances, other than crosstalk or distortion components, that occur at the output of the reproduce amplifier.

System Noise: The total noise produced by the whole recording system, including the tape. **Equipment Noise:** The noise produced by all the components of the system, with the exception of the tape. **Tape Noise:** The noise that can be specifically ascribed to the tape. There are several sources of tape noise. See DC Noise, Erase Noise, Modulation Noise, Saturation Noise, and Zero Modulation Noise.

Noise Gate – A device used to modify a signal's noise characteristics. In video, noise gates provide optimal automatic suppression of snow (signal noise level). In audio, a noise gate provides a settable signal level threshold below which all sound is removed.

Noise Pulse – A spurious signal of short duration that occurs during reproduction of a tape and is of magnitude considerably in excess of the average peak value of the ordinary system noise.

Noise Reduction – The amount in dB that the noise added to a signal by transmission or storage chain, especially a tape recorder, is reduced from the level at which it would be if no noise reduction devices were used.

Noise Reduction Systems – Refers to electronic circuits designed to minimize hiss level in magnetic recording.

Noise Weighting – An adjustment used in the electrical measurement of television signal noise values, to take into account the difference between the observable effect of noise in a television picture and the actual electrical value of noise.

Noise/A-Weighted – Unwanted electrical signals produced by electronic equipment or by magnetic tape. Mostly confined to the extremes of the audible frequency spectrum where it occurs as hum and/or hiss. A-weighted noise is noise measured within the audio frequency band using a measuring instrument that has a frequency selective characteristic. The frequency sensitivity of the measuring instrument is adjusted to correspond to that of the average human hearing response.

Noisy – A description of a picture with abnormal or spurious pixel values. The picture's noise is a random variation in signal interfering with the information content.

Noisy Video – Noisy video (e.g., video from low quality VTRs) is more difficult to code than the cleaner version of the same sequence. The reason is that the video encoder spends many bits trying to represent the noise as if it were part of the image. Because noise lacks the spatial coherence of the image, it is not coded efficiently.

Nomograph – A table that allows for the determination of Chrominance to Luminance Gain and Delay errors. Refer to the discussion on Chrominance to Luminance Gain and Delay.

Non-Additive Mix (NAM) – The process of combining two video signals such that the resultant video signal is instant-by-instant the same as the brighter of the two weighted input signals. For example, at 50% fader, the brighter of the two videos predominates. The net effect of this type of mix is a superimposed appearance, with the picture balance controlled by the fader.

Non-Compatible – Incapable of working together.

Noncomposite Video – A video which does not contain a synchronizing pulse.

Nondirectional – A pickup pattern which is equally sensitive to sounds from all directions.

Non-Drop Frame – System of time code that retains all frame numbers in chronological order, resulting in a slight deviation from real clock time.

Non-Ferrous – Without iron or iron oxide.

Noninterlaced – Method of scanning video in which the entire frame is scanned at once rather than interleaved. The rate of scan must be fast enough that the average light level of the scene does not decrease between scans and cause flicker. Another term for a noninterlaced system is progressive scan.

Non-Intra Coding – Coding of a macroblock or picture that uses information both from itself and from macroblocks and pictures occurring at other times.

Nonlinear – A term used for editing and the storage of audio, video, and data. Information (footage) is available anywhere on the media (computer disk or laser disc) almost immediately without having to locate the desired information in a time linear format.

Nonlinear Distortion – Amplitude dependent waveform distortions. This includes APL and instantaneous signal level changes. Analog amplifiers are linear over a limited portion of their operating range. Signals which fall outside of the linear range of operation are distorted. Nonlinear distortions include crosstalk and intermodulation effects between the luminance and chrominance portions of the signal.

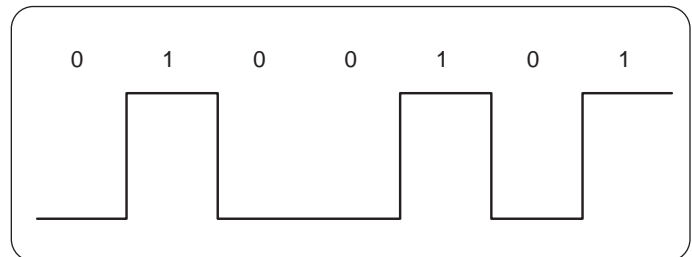
Nonlinear Editing (NLE) – a) The process of editing using rapid retrieval (random access) computer controlled media such as hard disks, CD-ROMs and laser discs. Its main advantages are: allows you to reorganize clips or make changes to sections without having to redo the entire production and very fast random access to any point on the hard disk (typically 20-40 ms).
b) Nonlinear distinguished editing operation from the “linear” methods used with tape. Nonlinear refers to not having to edit material in the sequence of the final program and does not involve copying to make edits. It allows any part of the edit to be accessed and modified without having to re-edit or re-copy the material that is already edited and follows that point. Nonlinear editing is also non-destructive, the video is not changed but the list of how the video is played back is modified during editing.

Nonlinear Editor – An editing system based on storage of video and audio on computer disk, where the order or lengths of scenes can be changed without the necessity of reassembling or copying the program.

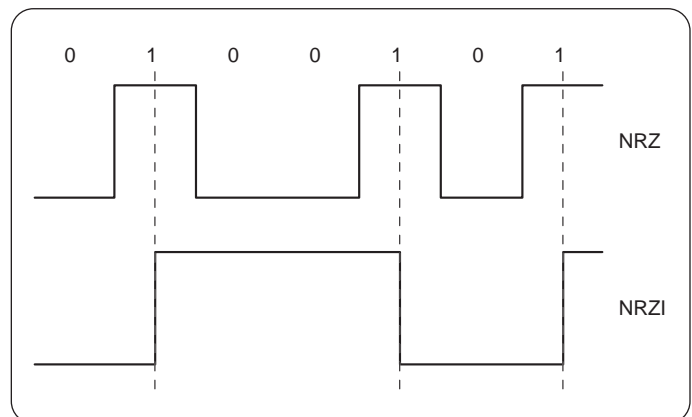
Nonlinear Encoding – Relatively more levels of quantization are assigned to small amplitude signals, relatively fewer to the large signal peaks.

Nonlinearity – The amount by which a measured video signal output differs from a standard video signal output. The greater this deviation, the greater the video signal distortion and possibility of luminance and chrominance problems. Having gain vary as a function of signal amplitude.

Non-Return-to-Zero (NRZ) – A coding scheme that is polarity sensitive. 0 = logic low; 1 = logic high.



Non-Return-to-Zero Inverse (NRZI) – A video data scrambling scheme that is polarity insensitive. 0 = no change in logic; 1 = a transition from one logic level to the other.



Non-Synchronous – Separate things not operating together properly, i.e., audio and video or the inability to properly operate together with another specific piece of equipment or signal. See Synchronous.

Non-Synchronous Source – A video signal whose timing information differs from the reference video by more than 800 ns.

Non-Uniform B-Splines (NURBS) – A superset of both Bézier and Uniform B-Splines. NURBS introduces the feature of non-uniformity. Thus it is possible to subdivide a spline, for example, to locally increase the number of control points without changing the shape of the spline. This is a powerful feature which enables you to insert more control points on a spline without altering its shape; cut anywhere on a spline to generate two parts; and creates cusps in splines.

Non-Useful DC Component – Produced by the transmission equipment and not related to picture content. The non-useful DC component present across the interface point, with or without the load impedance connected, shall be zero $\pm 50 \mu\text{V}$.

Video Terms and Acronyms

► Glossary

Normal – a) Relating to the orientation of a surface or a solid, a normal specifies the direction in which the outside of the surface or the solid faces. **b)** The normal to a plane is the direction perpendicular to the surface.

Normal Key – On the 4100 series, an RGB chroma key or a luminance key, as distinct from a composite (encoded) chroma key.

Normal/Reverse – The specification of the direction a pattern moves as the fader is pulled. A normal pattern starts small at the center and grows to the outside while a reverse pattern starts from the edge of the screen and shrinks. Normal/Reverse specifies that the pattern will grow as the fader is pulled down, and shrink as it is pushed up. This definition loses some meaning for wipes that do not have a size per-se such as a vertical bar, however, this feature still will select the direction of pattern movement.

North American Broadcast Teletext Specification – Provisions for 525-line system C teletext as described in EIA-516 and ITU-R BT.653.

Notch Filter – A device which attenuates a particular frequency greatly, but has little effect on frequencies above or below the notch frequency.

Notifier – A form that appears when the system requires you to confirm an operation that you just requested, or when an error occurs.

NRZ – See Non-Return-to-Zero.

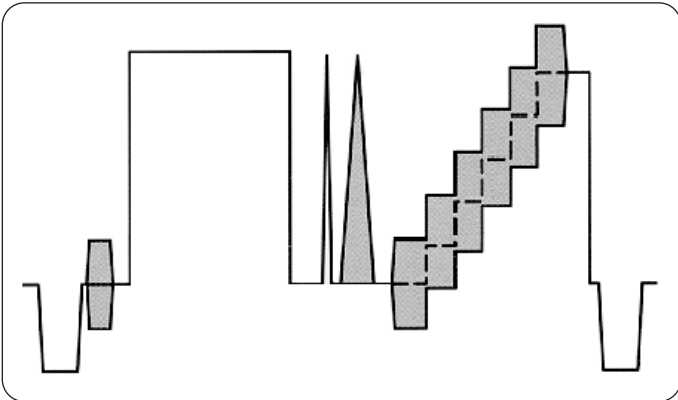
NRZI – See Non-Return-to-Zero Inverse.

NSAP – Network Service Access Point.

NSF (Norges Standardiseringsforbund) – Standards body of Norway.

NST – Network Status Table.

NTC-7 Composite Test Signal –



NTSC – See National Television System Committee.

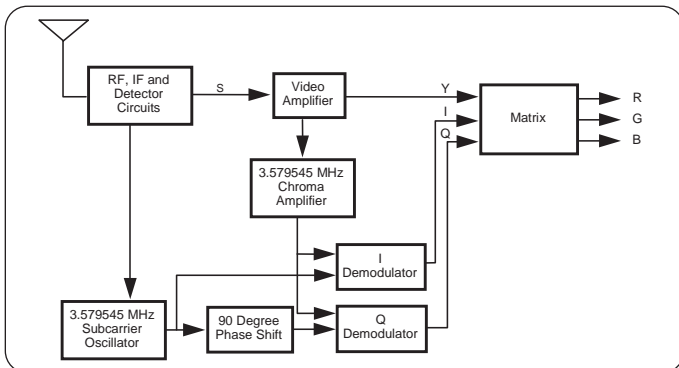
NTSC Artifacts – Defects associated with NTSC:

What's Wrong with NTSC

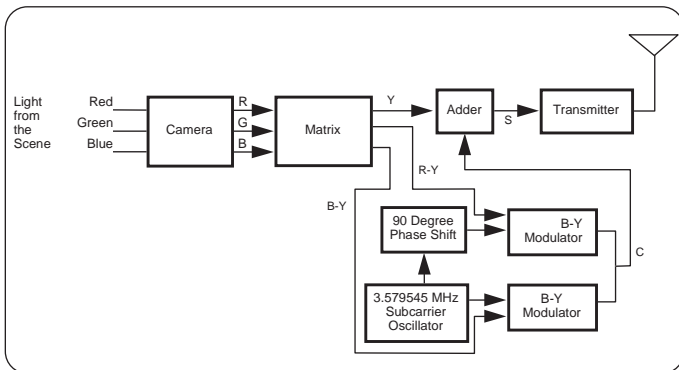
- A. Monochrome and Color Defects
 1. Due to Sampling
 - Temporal Alias
 - Vertical Alias
 - Vertical Resolution Loss (Kell Factor)
 2. Due to aperture
 - Visible Scanning Lines
 - Soft Vertical Edges
 3. Due to Interlace
 - Twitter
 - Line Crawl
 - Vertical Resolution Loss (Interlace Coefficient)
 - Motion Artifacts, Vertical and Horizontal
 4. Due to Transmission
 - Ghosts
 - ICPM
 - Group Delay
 - Impulsive Noise
 - Periodic Noise
 - Random Noise
 - Interference
 - Filter Artifacts
 5. Due to Changing Equipment
 - Non-Linear System Gamma
- B. Color Defects
 1. Visible in Monochrome
 - Cross Luminance
 - Visible Subcarrier
 - Chroma Crawl
 - Gamma Problems
 - Detail Loss Due to Filters
 - Ringing Due to Filters
 2. Visible in Color
 - Cross Color
 - Detail Loss Due to Filters
 - Ringing Due to Filters
 - Detail Loss Due to Triad Size
- C. Characteristics of the System (Not Necessarily Defects)
 1. 4:3 Aspect Ratio
 2. 330 x 330 Resolution
 3. NTSC Colorimetry
 4. 15 kHz Sound

NTSC Color – The color signal TV standard set by the National Television Standards Committee of the USA.

NTSC Composite Video Receiver System –



NTSC Composite Video Transmitter System –



NTSC Decoder – An electronic circuit that breaks down the composite NTSC video signal into its components.

NTSC Format – A color television format having 525 scan lines (rows) of resolution at 30 frames per second (30 Hz). See NTSC. Compare PAL Format.

NTSC MUSE – Term sometimes used for MUSE-6 and MUSE-9.

NTSC Standard – Documentation of the characteristics of NTSC. NTSC is defined primarily in FCC Part 73 technical specifications. Many of its characteristics are defined in EIA-170A. NTSC is also defined by the CCIR. NTSC is a living standard; as problems with it are discovered, they are corrected. For example, a former EIA standard, RS-170, omitted any phase relationship between luminance and chrominance timing, resulting in blanking problems. EIA-170A defines that relationship (called SC/H for subcarrier to horizontal phase relationship). See also True NTSC.

NTSC-M – The U.S. standard of color television transmissions. See also NTSC and M.

NTU – Network Termination Unit.

NTV (Nippon Television Network) – A Japanese broadcaster that is a proponent of ATV schemes similar to Faroudja's SuperNTSC. NTV's first generation EDTV system would use high line-rate and/or progressive scan cameras with prefiltering, adaptive emphasis, gamma correction, ghost cancellation, a progressive scan display, and advanced decoding at the

receiver. The second generation would add more resolution, a widescreen aspect ratio, and better sound. The first generation is scheduled to be broadcast beginning in 1988.

Null Packets – Packets of “stuffing” that carry no data but are necessary to maintain a constant bit rate with a variable payload. Null packets always have a PID of 8191 (all 1s).

Number Crunching – Action of performing complex numerical operations.

NVOD – Near Video On Demand.

NWK – Network.

NYIT – See New York Institute of Technology.

Nyquist – Nyquist Filter, Nyquist Limit, Nyquist Rule, and Harry Nyquist, for whom they are named.

Nyquist Filter – Commonly used in the IF stage of a television receiver to separate the desired television channel from potential interference.

Nyquist Frequency – The lowest sampling frequency that can be used for analog-to-digital conversion of a signal without resulting in significant aliasing. Normally, this frequency is twice the rate of the highest frequency contained in the signal being sampled.

Nyquist Interval – The maximum separation in time which can be given to regularly spaced instantaneous samples of a wave of bandwidth W for complete determination of the waveform of the signal. Numerically, it is equal to $1/2 W$ seconds.

Nyquist Limit – When time-varying information is sampled at a rate R , the highest frequency that can be recovered without alias is limited to $R/2$. Aliasing may be generated by under sampling temporally in frame rate, or vertically in lines allocated to image height, or horizontally in analog bandwidth or in pixel allocation. Intermodulations prior to band limiting may “preserve” some distracting effects of aliasing in the final display. Note: Sampling at a rate below the Nyquist limit permits mathematical confirmation of the frequencies present (as for example in a Fourier analysis of recorded motion). If the sampling window is very small (as in synchronized flash exposure), however, it may become a subjective judgment whether strobing is perceived in the image for motion approaching the limiting velocity (frequency).

Nyquist Rate Limit – Maximum rate of transmitting pulse signals through a channel of given bandwidth. If B is the effective bandwidth in Hertz, then $2B$ is the maximum number of code elements per second that can be received with certainty. The definition is often inverted, in effect, to read “the theoretical minimum rate at which an analog signal can be sampled for transmitting digitally.”

Nyquist Rule – States that in order to be able to reconstruct a sampled signal without aliases, the sampling must occur at a rate of more than twice the highest desired frequency. The Nyquist Rule is usually observed in digital systems. For example, CDs have a sampling frequency of 44.1 kHz to allow signals up to 20 kHz to be recorded. It is, however, frequently violated in the vertical and temporal sampling of television, resulting in aliases. See also Alias.

Nyquist Sampling Theorem – Intervals between successive samples must be equal to or less than one-half the period of highest frequency.