ASHLEIGH NASH
605N0900
JMS4
TELEVISION
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TECHNOLOGY MANUAL

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TECHNOLOGY MANUAL:

DISCLAIMER: This technology manual includes some basics as well as troubleshooting tips specific to my needs regarding specific hardware and software issues. Some it is my own understanding and other information is copied from manuals. The manual works on basic understandings of television production.

Basic Camera Features:
CANON XL1
Camcorder
Double Resolution
Interchangeable Lens

Features:
Robust
Professional Lens
Non-automation
Manual Access to Shutter
DV Tapes: cheap &Light
Wide angle lens opportunities
Mimics behaviour of complex camera
Manual focus (1-16 optical zoom)

User-oriented interface

Excellent manual functions for professional needs

5 hours 50 minutes continuous shooting with CH-910 and 2 x BP-945 Battery pack

Video Basics

PAL:
Phase Alternating Lines
625 line system

RGB (Red, Green, Blue):
Separates channels of light and brings them back together

Standard definition:
540 lines of resolution

High Definition:

Video System of higher resolution than standard definition i.e. 1080 or 720 line resolution.

Colour levels

Black level-absence of white
100% white-loss of detail

Crushing the blacks:

Light forced to 0 volts
Critical to not lose detail

Zebra:

Used to monitor high spec. Lighting situations and signify 100% white voltage mark
A series of diagonal stripes appear in the viewfinder to signify areas of overexposure

Ratios:

3:4 is ideal for regular television outputs.
16:9 can be chosen on the camera software menu for wide-angle outputs i.e. film screens

Shooting Modes:

Full auto Mode (Green Square):

Point & shoot
Camera takes care of focus, exposure and other adjustments
This also means that manual functions may not be used i.e. shutter and 16:9 effects

Automatic: **A**

Not unlike full auto mode method but access to manual functions except sound, white balance

Manual: **M**

Allows complete manual freedom, even allowing the user to set aperture and shutter speeds.

Spotlight:

The exposure is automatically adjusted for glare-free recordings of subjects lit by a concentrated light source.

TV:

Allows user to select shutter speed therefore manipulating exposure.
50 shutter clicks per second, iris locked away

AV Mode:
Allows user to select aperture thereby giving control over depth of field.
Iris locked away

Movie Mode:

The CCD's capture 30 full frames instead of 60 half frames per second. This results in a "film look".

Wide, crisp & panoramic shots.

Further Additions:

Wireless Controller/Sensors:
A wireless controller can operate the camera from up to five metres via sensors located on the front of the camera. Functions include special playback and self-timer.

Tally Lamp:
This is a red light at the front of the camera that lets you know when the camera is recording. This helped journos or reporters to be cued in.

Optical Stabilising Setting
Compensates for a wide range of camera movement.
Stabilises moving images i.e. from a car.
Slide the stabilizer switch on the video lens before recording.
3 CCD
Greater range, trueness of colour, saturation

Natural density filter:
Reduces the amount of light passing through the lens and allows the user to maintain a normal shutter speed no matter the situation.
Also used to create a shallow depth of field, making the subject in focus with the foreground and background out of focus
Located on the camera's lens.

Ways in which to manipulate recordings on Manual

Depth of field:
The area in which objects located various distances from the camera are in focus.
This is great for ideological, semiotic messaging, depending what the filmmaker is aiming for. For example subjects on the same focal plane means they are the same. One can choose subjects/objects to be in/out of focus and can isolate a character in the focal plane by virtue of sharpness.

Shutter manipulates depth of field through light. There are three ways in which one can manipulate depth of field.

1. Iris/Aperture

The iris is the mechanical part of the camera, which controls the amount of light coming into it. In manual mode the f-stop is the menu function that controls the size of the iris. Increasing the f-stop means less light comes in and vice versa. If the opening of the iris is large, this denotes a shallow depth of field and a fuzzy image. A smaller opening creates a great depth of field or ‘flat’ focal plane in which the image, and specifically, centred subject is 2D and crisp.

2. Distance from optical centre of the lens to the front surface of the camera’s target.

This is self-explanatory and is manipulated via the manual zoom ring on the lens (in mm), or the zoom buttons on the actual camera. A zoom out translates to a short focal length and great depth of field whereas as a zoom in is a long focal length and shallow depth of field.

3. Physically move camera closer or further from object

<u>Important tips:</u>

To create a great depth of field, one may manipulate all three of the above actions simultaneously

Make sure the image seen in the viewfinder of the camera matches the actual visuals especially in terms of light.

In Practice, it is important for the filmmaker to use mechanisms such as depth of field to create hints to the message he/she is trying to get across i.e. the decision to separate or mesh a subject with their environment is an important one.

<u>Focus:</u>

If the camera is set to **<u>Auto</u>** it is also set to autofocus:

Autofocus will always take the centre of the composition as a reference. Therefore when using autofocus, make sure the subject, or most important element, takes the centre.

Setting the camera to **<u>Manual</u>** enables one to manipulate the focus:

Using the focus ring around the camera lens enables one to attain a closer focal plane (anticlockwise) and a further focal plane (clockwise). It is imperative to learnt this as turning the ring the wrong way can destroy a shot.

There is, however an autofocus button. When this is depressed the subject that is/was in centre will stay in focus, even if they move into a different focal pane. On this setting the cameraperson must provide the movement in order to change the autofocus.

<u>ND Filter:</u>

On a bright day or when recording very bright scenes, blurring of the image may occur. By switching the filter ON this blurring may be controlled. The ND Filter is located on the body of the XL lens.

<u>White Balance:</u>

Setting the white balance manually will probably work better than auto white balance when shooting:

- Subjects with one dominant color, such as sky, sea or forest.
- Close-ups.
- In rapidly changing lighting conditions.
- In places lit by certain types of fluorescent or mercury vapor lights.

<u>How to set it:</u>

On Manual Mode:

1. Turn the POWER dial to any recording program (except the Easy Recording Program).
2. Press the white balance selector knob so that it pops out. You can now turn it to choose between A for auto white balance, for indoor lighting, for outdoor lighting, or turn it to the right to set the white balance manually.

a) Point the camera at a white object (such as a sheet of paper) and if you are using a zoom lens, zoom in until it fills the display.
b) Press the WHITE BALANCE set button.
• The white balance symbol flashes quickly in the viewfinder and then remains lit, to show that the camera has set the white balance.
• Depending on the light source, the flashing may at times change to a slower speed, rather than remain lit. The result will remain better than with the auto setting, and you can continue recording.
c) Turn the white balance selector knob back to A to return to the auto setting. Push the knob back in when you have finished making selections.

If the lighting conditions change, reset the white balance by first returning to the auto setting, and then reselecting the manual balance.

Try to record with light from a single source. Correct white balance cannot be obtained for two types of lighting at once.

When you turn the camera off, the camera remembers your white balance setting.

Other Camera/Filming Tips:

Be aware of ZOMALITIS. Amateur filmmakers have a tendency to zoom in and out of shots to the detriment of the shot. Most of the time, one needs to let the action play out.

Once you have set a shot, especially for an interview…leave the camera alone. This avoids the twitching effect during shots. The cameraperson should only change shots i.e. from a medium shot to close-up in-between questions.

Panning is a skill hat takes some practice. One should rest for 5 seconds at the beginning and end of a pan. The pan should also not move too quickly or too slowly, depending on the distance covered.

CABLES:

Cables are an extremely important element in the technical side of television. They are not only important for sound rigging but also for routing audio and/or video from the camera to external devices and vice versa. The following is a description of different digital and analogue cables and their capabilities.

VIDEO	**AUDIO**	**CONTROL**
BNC		Kettle plug
Firewire (4 to 6)	Firewire (4 to 6)	
RCA	RCA	
		9 pin remote
Component (RGB)		
S Video/SVHS cable		
	XLR	
	Jack	

Basics:

3 prong plugs are 15 amp whereas 2 prong plugs are 13 amp

3 prong plugs include live, neutral and earth prongs whereas 2 prong plugs are not earthed.

Coaxial Cables is the umbrella term for most cables

BNC:

The BNC is a professional coaxial cable that transfers high quality video signals. The cable is analogue with a male output and can split the signal sending it, through a DA, to multiple receivers i.e. monitors. An example of this cable would be those connected o professional DVD players.

NOTE: A DA is a distribution amplifier, which steps up the strength of a signal to overcome resistance from cabling

FIREWIRE:

Firewire, aka IEEE or 1394 protocol, is an Apple developed digital video cable. Type 4 to 6 is best suited to our needs as TV students as it carries data from the camera to firewire capture cards.

RCA:

This analogue coaxial cable carries video and audio signals and used with DVD players in their domestic format. I also has pathway control capabilities. BNC Cables can also connect to RCA plugs via jacks and adaptors. The current competing protocol to this cable is the USB2 protocol. The Firewire 400, which we use with our cameras, is slower than the USB2

COMPONENT:
This thick cable enables the signal to be carried along three different pathways, namely RGB (Red, Green, Blue). This gives the signal a high quality (SDIF).

Svideo/SVHS cable

This video-only cable enables a clean signal ideal for monitoring, dubbing etc. Also known as a Y/C cable, it transfers signal between composite and component. A common routing is from DV decks into big monitors via Y/C inputs.

REMOTE:
A 9-pin is the most common in this family of cables. It is purely a control cable and does not carry audio or video signals. It purely carries control information in order to control devices i.e. ordering a device to stop, eject etc

XLR:
The stereo XLR is a very common audio cable, which we use most often in routing sound through microphones, cameras and the sure mixer. The cable is either 3 pronged for female inputs (male) or has three female inputs itself (female). The cable is stereo in that audio data is sent through three pathways: left, right and neutral. A low quality cable often undermines the value of the signal.

JACK:
This common audio only cable is a male input that plugs into a female jack plug. Two rings on its tip signify that it is a stereo XLR jack. For certain situations, a small adaptor can transform the stereo jack into a mono RCA jack i.e. transmitting audio from a mixing desk into a tape recorder.

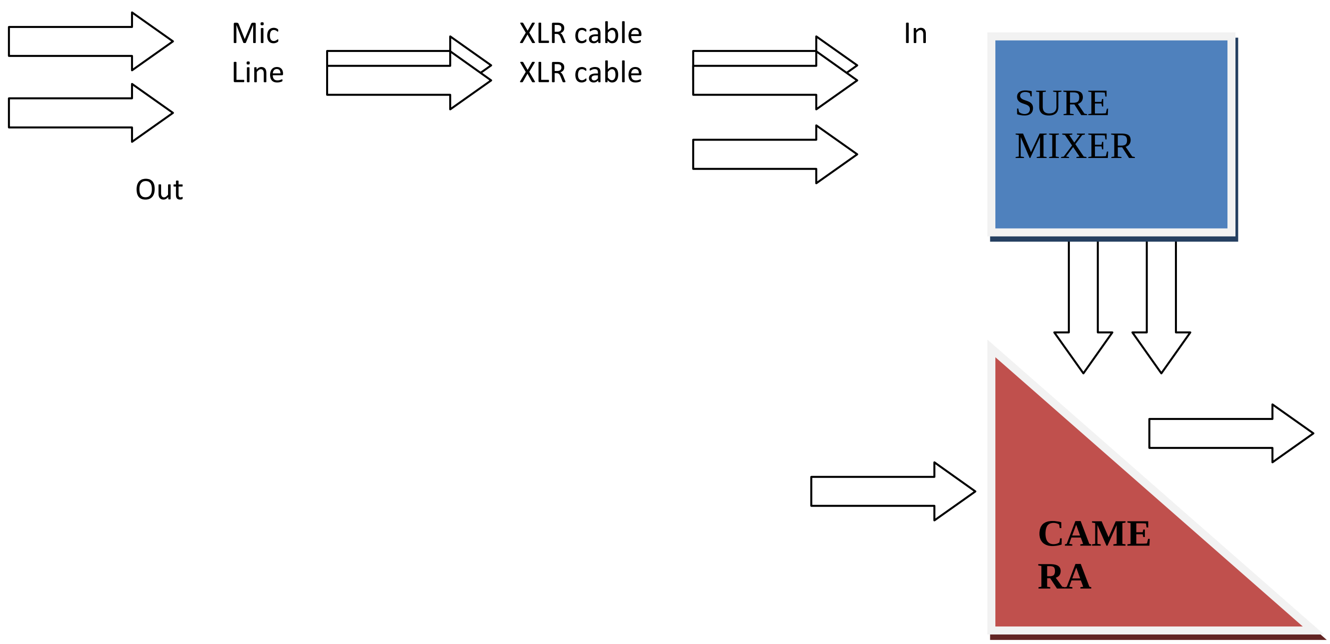
Balanced vs. Unbalanced Cables:

A balanced cable does not mean that it balances sound in terms of left and right. Balanced means that the cable is much less susceptible to resistance and interference form other sources that may affect the signal. Unbalanced cables, therefore, do not have these properties and the signal succumbs to interference.

SOUND:

Db: ratio of units of sound
16 bit: 2 channels, best sound
4 channels of audio
48KHz, 16 bit sound
2 channels makes 'fatter' sound

Audio Pathways:



(Sound enters the camera via left and right channels that can be mono or routed back through the mixer to become stereo) **AUDIO**

Basic digital audio recording

- DV (digital video) format: Pulse Code modulation – audio recorded on drum separate to video
- Sound waves = vibrations: frequency; wavelength = low (bass) & high (treble)

  Amplitude; height of wave - volume
- MIC > analogue-to-digital converter
- Playback quality depends on number of samples/sec (binary digits/bits-controls noise& distortion)

- Digital measures in steps where analogue is continuous
- There is no degradation in digital recording

16-bit stereo (48 kHz, 2 channel)

- Highest sound quality

12-bit stereo (32 kHz, 2 or 4 channel)

Choosing the output Channel
Make sure camera is set to VCR mode. Open the menu & select the output channel you wish:
L/R (Stereo) = default
Normal stereo mode – left-side signal +output at left channel terminal & the right-side signal +output at right channel terminal

Audio mode 16-bit/12 bit stereo 1, audio signal will be sent to RCA jacks labelled L&R Stereo 1 for output at stage A, Stereo 1 (L&R) will be sent to RCA jacks labelled Audio 2(L&R) & stereo 2 (L&R)>
RCA jacks labelled Audio 2(L&R) = 4 independent audio signals
Mixed the balance at Stage A, combination of left channels from stereo 1&2 sent to left channel of Audio 1 & combination of right channels will be sent to right channel of Audio 1

L/L only left side signal is output to RCA left & right jacks. For reproducing only main voice of bilingual information recorded on other equipment
R/R only the right side is output to the RCA left & right jacks. For reproducing only sub voice of bilingual information recorded on other equipment
L+R+R
Gives a mono output. Sound from the left and right channels are combined & sent to the left RCA jacks

SURE MIXER:

TONE:
To set tone:
Push switch on mixer (set at 1Khz)
Master Switch: Set levels at -4db
Set to -12 Db on camera

MICS:

Radio:
This is a wireless microphone that has a transmitter and receiver (cordless).
Freedom of movement for subject and crew
But limited range, low battery life

Lapel (Lavalier):
Good for hands free operation
Comes with a small clip to be attached to collars, shirts etc. via a cord connecting to the camera.

Stereo:
Attaches to the front of the camera and is used for anti-directional situations i.e. marches, rallies etc.

Rifle:
The rifle or 'boom' mic attains a high quality sound especially when background noises could compromise the desired sound. It is wired to the camera via an XLR cable and must be switched on via a switch located inside the boom sheath and protective fluffy covering. The mic should be kept within a metre and a half of the subject for the best results with the mic pointing upward outside and downward inside.

Codecs:

DVD formats:

Americans watch compressed video on DVD more than on any other media. A DVD-5 disc can hold nearly 5GB of data, which is enough for a high-quality, two-hour movie. The type of DVD that plays in a DVD player is most accurately known as DVD-Video

DVD-Video discs are mastered in either National Television System Committee format (known as NTSC, the format used in the U.S. and Japan), or Phase Alternating Line format (known as PAL, the format used in Europe and most of Asia). Home DVD players designed to play one format typically won't play discs in the other format; however, computers can typically play both types.

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VideoCD is an older disc-based format. It has much lower resolution and higher compression ratio than DVD, and so it provides lower quality. However, it uses standard CD-ROM discs, so VideoCD discs can play in a variety of devices. Like DVD, VideoCD discs can be either NTSC or PAL.

CD-ROM: the web has largely replaced CD-ROM as a medium for interactive content; people still use CD-ROM video for many applications, such as computer games and kiosks. Compared to web video, CD-ROM offers much higher bandwidth than broadband connections, and is capable of DVD quality on fast computers.

INTERNET:

The web is the medium providing the most encouragement for development of video compression technology. The bandwidth available on the web is much less than on discs, so it is critical to make every bit of data count.

Web video can use either real-time streaming mode or progressive-download mode. Real-time streaming files require specialized streaming server software and are limited in quality by the bandwidth available between the server and the end user. Progressive-download files load from standard web servers, and may take a long time to download, but may also provide higher and more reliable video and audio quality

Mobile Formats:

Most compressed video formats can be played on some mobile devices, including Adobe® Flash® Video, MPEG-4, Microsoft® Windows Media, and RealMedia. Dedicated mobile formats, like Kinoma, are also available.

Compression:

Often large vie files need to be compressed in order to transport them over a network or the Internet i.e. making high and low-resolution versions for our website involves compression.

The ratios between data rates used for authoring video and for distributing compressed video can be huge. For example, converting an uncompressed source to a modem-compatible video requires about a 9000:1 compression. That leaves only about 0.1% of the original data left.

Fundamentals:

Compression technologies take advantage of the strengths and weaknesses of human senses by reducing data that isn't likely to be perceived. Fundamentally, compression works by summarizing a sequence of images and sounds as efficiently as possible.

CODEC:

A matched pair of a compressor and a decompressor, better known as a codec, performs the compression. A compressor is part of the encoding process, reducing the amount of data required to store the video. A decompressor works on the receiving end, decoding the compressed data so that it can be presented to the viewer. It's important that the pair be matched because the decoder (decompressor) needs to understand the encoder's (compressor's) summary of the data.

Many codecs are based on a technique called discrete cosine transformation (DCT). These codecs deal very well with smooth gradations in an image, but they may not be as successful at encoding random details or sharp edges at lower bit rates.

Video Codecs use two types of compression:

Spatial:

Spatial compression, also called intraframe compression, affects only a single frame at a time. This type of compression makes random access to any point in the video and editing easy.

Temporal:

Temporal compression, also called interframe compression, adds the ability to use other frames as a reference for the current frame. In video, each frame tends to be similar to the frame preceding it. Temporal compression encodes only the changes from one frame to another

Color Modes:

Monochrome In a monochrome mode, only luminance (brightness) matters. This color type works great for black-and-white movies.

Red, Green, Blue (RGB): Computer screens and televisions are natively RGB—the screen has red, green, and blue phosphors for CRTs and planes for LCDs. RGB isn't very efficient for video content, so RGB codecs aren't used for broadcast video delivery anymore.

Y'CbCr (also called YUV, although YUV properly only refers to how colour is used in NTSC video): These codecs encode luminance and two color-difference channels. This process greatly reduces data rate and processing requirements. You can convert RGB to and from Y'CbCr adequately, but there are always some colors that are available in one mode but not the other, and there can be rounding errors as part of the conversion.

Colour depth (bits per channel – bpc) and **colour sampling** i.e. 4:4:4 are also important tenets to the colour compression

AUDIO COMPRESSION:

Sampling rate

The most fundamental factor in audio is sampling rate, which is measured in Hertz (Hz), or cycles per second. Audio CDs use 44100 Hz, or 44.1 kilohertz (KHz), which provides excellent reproduction.

SAMPLE	USED	SUFFICIENT FOR
8 KHz	Phone system	Speech
11 KHz	Old multimedia standard	Better speech
22.050 KHz	Also old multimedia standard	Recognizable music
32 KHz	Common in broadband video	Minimum for decent music
44.1 KHz	Audio CD	Music
48 KHz	DVD, DAT	Music
96 KHz	High-end audio recording	Music mastering

Bit depth

Bit depth is the number of bits used for each sample in each channel—the higher the bit depth, the better the audio quality.

- **8-bit sampling:** Originally, multimedia audio used 8-bit sampling, which means there was a measurement of volume from 0-255 for each sample. This bit depth, which was responsible for that harsh sound in the early CD-ROM titles, produces fairly poor quality audio.

- **16-bit sampling:** This bit depth is the current standard for audio distribution. Most modern codecs and all audio CDs use 16-bit sampling as well.

- **20-bit sampling:** This bit depth is used for professional audio recording to provide a better dynamic range than 16 bits. Codecs that support 24-bit audio (described later) can effectively take advantage of 20-bit sources

- **24-bit sampling:** This bit depth is rapidly becoming the standard for professional audio recording because it provides more sonic detail than 16-bit sampling, meaning you can use many more effects and layers without introducing errors. A few delivery codecs now support 24-bit sampling, most prominently Microsoft Windows Media Audio (WMA) Professional.

Perceptual audio compression: Reducing the sample rate and number of channels can reduce the data rate; however, good compression must go well beyond that. Most modern codecs use perceptual encoding techniques: that is, an internal model of the human auditory system determines the important parts of an audio source and spends the available bits on those parts. At low data rates, the audio can still sound quite altered from the source. The number of bits required for “good enough” quality has been dropping precipitously in recent years.

You can’t measure compression efficiency with a single number. Relative performance varies greatly and depends on the source and the data rate. Typically, the higher the data rate, the smaller the quality differences.

Creating Content for Future Compression:

It I also very important to create content that compresses well. There are many ways this can be achieved in the pre-production, production and post-production phases.

Pre-production:

In pre-production, you plan the various elements of a project. It’s best to introduce the idea of compression early in a project; so all members of the team can consider the implications.

Production:

Deciding between interlaced and progressive (better for PC content) scan. Often when creating web versions one would 'deinterlace' as the interlacing method works better with video and may cause field jitter.

Camera motion: still sots are easily compressed whereas pan and tilts are more difficult. However, In post-production, the motion stabilization tools in After Effects can remove unwanted camera motion before compression to reduce the size of the output video file.

Shutter speed: This speed controls how long the aperture is open in the camera, and hence, how long light hits the film or the CCD. Slower shutter speeds let through more light, and hence less grain, which helps compression. Slower shutter speeds also cause moving parts of the image to become blurry, which makes them easier to compress.

Backgrounds: The background one uses in the shot has an effect on compression capabilities. For example, compression does not like foliage rustling in the breeze as green makes up the majority of luma.

Depth of field: A useful and subtle technique for controlling the complexity of images is depth of field. By managing the depth of **fi**eld, you can keep unimportant objects in the background or close foreground out of focus while clearly showing the actual subject of the shot.

Post-Production:

These can obviously based on the results of test compressions, which makes fine-tuning easier.
Static vs. Moving Images

Motion Blur: one can also manipulate this in After Effects

Anti-Aliasing: rendering technique that smoothes out edges

Progressive rendering: deinterlacing

CAPTURING techniques for better compression:

The higher the quality of the source material used, the higher the quality of the final compression results.

Video can be captured from analog or digital sources. Both have a variety of different video and audio formats available and various physical connection types that can be used.

Analogue Formats:

Analog video uses fluctuating voltage and frequency signals to transmit image data. It ranges greatly in quality but is inherently susceptible to visual interference from electronic noise, like power lines, and suffers attenuation, or the loss of signal power and quality over long cable runs (usually 300 meters or more). Because computers only use digital data, the analog source must be converted to a digital copy to be captured. When it is sent back to an analog medium like videotape, it is converted back to an analog signal. This conversion can lead to minor errors (quantization errors) being introduced because of the imprecise relationship between analog and digital signals. You can minimize these quantization errors by using the right format, good equipment, cables, and connections.

- **Composite:** carries luma and chromo in one signal: susceptible to chroma to leakage of one into the other. Used in broadcast mainly i.e. VHS
- **Svideo (Y/C):** The introduction of the S-Video format was a major advance in quality for consumer and professional video editors. S-Video splits the luma and chroma channels into two separate wire pairs, which eliminates generally half of the composite noise artifacts.

- **Component Analogue (YUV):** With component analog, the luminance signal and the two color signals are all transmitted over their own dedicated cables. Because all three components or channels of the video signal are transmitted independently, the quality of the signal is quite high. Noise is very low and the colors in the video are richer and more precise.

Digital Formats:

This format does not suffer from interference like analogue formats and this results in a cleaner and crisper signal.

DV: This format uses firewire and it revolutionized the video editing industry, becoming the fastest growing format for new editors and the de facto standard for news, owing to the small size and relatively low cost of DV camcorders. Video is compressed 5:1 during acquisition or recording in order to reduce the data rate of the signal to 25 Mbps. The data on the computer is exactly the same data as on the tape, so the result is a perfect copy. Adobe Premiere Pro supports DV25 and DV50 over standard FireWire ports.

SDI (serial Digital interface): SDI is a high-end, professional format for digital signals and is the standard in broadcast Industries

Digital Audio: There are many different digital audio formats. Consumer-grade digital audio is carried on electronic (such as S/PDIF) or optical (such as square TOSlink or round Miniplug) connection cables. Digital video carries an embedded digital audio signal with the digital video signal.

Web Video Components:

Choosing the right capture Codec:

The choice depends on the capture hardware you're using, the format from which you're capturing, and your storage requirements. There are three basic types of codecs to choose from: DV, Motion JPEG, and uncompressed.

Choosing a file format for rendering:

You can choose from a variety of file formats for rendering. The most common formats are QuickTime and AVI; both offer good-quality intermediate codecs. You can also use MPEG-2 at high data rates. Modern tools like After Effects and Adobe Premiere Pro can export to Windows Media 9 format. It is essential to make sure that the encoding tool supports the file format.

Choosing a codec for exporting:

When you export an intermediate pick a codec and a data rate that doesn't introduce compression artifacts. When you are not preprocessing, it's typical to use the source codec or Motion JPEG. When you use Motion JPEG, use it in single field when you export as progressive scan, or interlaced when you export as interlaced.

Why preprocessing matters

Preprocessing is one of the more subtle steps of compression, and it is often the most time consuming and difficult. It's also very important for quality, and getting it right can dramatically improve the quality of the video. A well preprocessed video can look better than the same source file poorly preprocessed, but can be encoded at twice the data rate

Preprocessing is critical for web video, but generally it is not needed when you convert to video formats like MPEG-2 for DVD or SVCD. Because those formats are played back as video, instead of on a computer screen, you can leave them as-is.

Also, you can create rendered graphics natively for computer playback without preprocessing.

Deinterlacing video
The most basic and critical form of preprocessing for the web is deinterlacing. Most video is produced and edited as interlaced (although, an increasing amount is done as progressive scan). But almost all web video is encoded as progressive scan. If the source frame of video is left with interlaced lines intact, the output shows the stacked lines. The lines look bad, but worse, those lines have sharp edges and are difficult to encode. So, at the same bit rate, deinterlaced video shows fewer artifacts than interlaced video.

Cropping and Scaling the pictures also lends to different web video formats. Aspect ratio correction is important in this regard i.e. from 4x3 to16x9. The key to getting aspect ratio correction right when you convert to square pixel sources from nonsquare pixel sources is to make sure that the output frame size matches the source aspect ratio

Audio Processing: Provides half the experience so is equally as important as video processing.

Resampling audio: For low data rates, especially those targeting dial-up modems, you should reduce the audio sample rate to 22.050 KHz or lower. Modern video editing applications use algorithms for rate resampling, which provide much better quality than the algorithms of a few years ago.

Setting volume: The peak volume should be slightly below the maximum volume. Using a compressor/limiter to reduce dynamic range, you can sometimes improve audio quality at very low data rates. In general, television broadcast audio is easy to encode because the audio has already been processed through compressors and limiters.

Adjusting channels and bit rates: Mono content encodes better than stereo at lower data rates. Consequently, it’s preferable to convert the audio from stereo to mono when you target lower bit rates (typically anything below 32 Kbps).

Reducing noise: There are also noise reduction filters for audio, although these filters are normally part of professional audio tools like Adobe Audition®, not a part of the compression tools. Providing clean, undistorted, hiss- and pop-free audio source results in better compression.

ENCODING

This is extremely important to the science of compression. Encoding means defining the correct parameters, such as data rate, frame size, and frame rate, according to the codec used to get optimum results for the project. Balancing these parameters can be difficult because there are many trade-offs.

Data Rate Modes:

Average limited is the most common type of data rate limitation. In this mode, you specify the average data rate, and the codec tries to make sure that the file ends up at the requested average.

Peak limited encoding is generally meant for hardware devices or high-data-rate content where the speed of the decoder (CPU, memory, or disk) is the limiting factor.

Buffer limited encoding is the method of choice for real-time streaming

Quality limited encoding is different from the other methods because it doesn't specify a data rate. Instead, it specifies a quality target, and each frame uses as many or as few bits needed to reach that quality target. This mode isn't compatible with real-time streaming.

Choosing between encoding speed and quality

Many codecs offer a control that specifies a trade-off between encoding time and quality. The faster modes typically perform much less exhaustive motion estimation. Generally, big speed changes cause much smaller quality gains—an eight-times slower encoding process might only have 20% better compression efficiency. The correct trade-off between speed and quality varies depending on the project. For DVD projects, titles under an hour won't gain much by slower, higher-quality encoding because the data rate is so high. Web-distributed content almost always benefits from the slower, high-quality encoded files, because bandwidth is so often the limiting factor for web video.

Setting frame size and aspect ratio

Adjusting the frame rate

Frame rate is the number of frames per second at which the video runs. Higher frame rates appear smoother, and lower frame rates appear choppier. Anything below 20 fps doesn't appear smooth, and below 10 fps, the video looks more like a filmstrip than moving video.

Negotiating frame dropping:
If the bits that the codec would normally allocate to a given frame aren't sufficient to hit the target quality, it raises the data rate for the frame to the minimum required for quality; then drops one or more frames that follow to keep the average data rate on target. Whether this process is appropriate depends on the content. For entertainment content, such as movies and especially music videos, having the video smoothly in sync with the audio is important, so frame dropping is not recommended

How keyframe rate comes into play: Keyframe rate controls the number of keyframes (I-frames) that are inserted in the video. Depending on the tool or the format, keyframe rate is measured in a keyframe every x frames or a keyframe every x seconds. MPEG-1 and MPEG-2 require a lot of keyframes; typically two per second. Web formats might have only one keyframe every 10 seconds.

Video Delivery
Disc-based
Downloadable Files
Progressive Download Files i.e. Utube
Real-time Streaming

Choosing a Compression Format
The format will all depend on meeting the project requirements i.e. compression efficiency and real-time streaming scalability; user base and OS platforms

In many cases, especially when you create content for the Internet, it may make the most sense to deploy content in multiple formats so that the user has the choice. Still, most consumers of digital media have already installed the players for the major formats.

1. **Windows Media** Format (see table)
    - Streaming
    - Progressive
    - Disc-based

Windows Media is the Microsoft digital media technology. Originally introduced as NetShow, it has improved significantly, and the Windows Media 9 platform, released early 2003, is a popular proprietary digital media platform

Windows Media has a variety of different players and audio codecs.

2. **RealMedia** Format

RealMedia is the oldest real-time streaming web format; the pioneering RealAudio debuted in 1995. RealNetworks has continued to enhance it; the updated Real 10 platform was announced in January 2004.

Unlike Windows Media, most RealMedia tools specify the total data rate from which audio data rate is subtracted to leave video data rate. However, some tools don't use this method—it's important to know the mode a particular tool uses.

Also includes streaming, progressive and disc-based options as well as vide and audio codecs

3. **Quicktime** Format

QuickTime is the oldest of the mainstream digital media formats; it was introduced in 1991. It predates the modern, widespread popularity of the Internet and even the CD-ROM drive as standard computer equipment, and has matured to support a wide variety of applications (although it is less advanced than RealMedia and Windows Media for real-time streaming). The greatest strength of QuickTime is that it supports rich interactivity and rich media.

Also includes streaming, progressive and disc-based options as well as video and audio codecs

4. **MPEG-1** Format

MPEG-1 was the first open multimedia standard. The original vision for MPEG-1 for computers was that users would buy add-on MPEG-1 decoder boards for their computers for playback. However, this vision didn't become popular, so MPEG-1 playback didn't happen widely until computers became fast enough to perform all of the decoding in software.

VideoCD, a precursor to DVD, also used MPEG-1. While it didn't get used much elsewhere in the world, VideoCD became enormously popular in Asia.

MP3 is also technologically related to MPEG-1.

Also includes streaming, progressive and disc-based options as well as video and audio codecs

5. **DVD and MPEG-2** Formats

Measured in the number of hours of video watched by viewers, MPEG-2 is easily the dominant digital-video format worldwide. It's used in virtually all digital broadcast systems (digital cable, satellite, and broadcast), as well as DVD.

One strength of MPEG-2 is the way it handles progressive and interlaced content. Entire streams can be interlaced or progressive. Interlaced streams can have progressive frames in them, and interlaced frames can have progressive blocks in them.

Also includes streaming, progressive and disc-based options as well as video and audio codecs.

6. **MPEG-4** Format

MPEG-4 is the follow-up ISO standard to MPEG-1 and MPEG-2. Unlike those formats, which were created before the popularity of the Internet and were strictly focused on audio and video playback, MPEG-4 is a much broader and extensible format. The format has major licencing issues is only now becoming well known.

Includes audio and video codecs

7. **AVI** Format

The Microsoft Audio Video Interleave format was a very early format for CD-ROM, and it is still widely used in a variety of applications.

Using AVI for web delivery
AVI is not a good web format because it doesn't support real-time streaming. Also, the set of codecs that are available by default on all computers is relatively limited. AVI files on the web are almost always distributed as complete files.

Using AVI for disc-based delivery
AVI is still a popular format for disc-based playback. It's well supported in applications, such as Adobe® Director, and because codecs can be delivered with a disc, installations are much less of a worry.

Includes audio and video codecs.

EXTRA:

EXTENSIONS

There are many different file types and extensions for Windows Media format. Here are some of the most common extensions and their meanings:

.asf

The file format used for Windows Media files is called the Advanced Streaming Format, and the original extension was .asf. However, this extension didn't discriminate between audio-only and video files, and so the extensions .wmv and .wma were introduced with Windows Media 7. Today, .asf files are typically legacy content using the Microsoft MPEG-4v3 video codec. However, the file format itself hasn't changed.

.wmv

A Windows Media Video file (.wmv) is an .asf file that contains video.

.wma

A Windows Media Audio file (.wma) is the same as an .asf file, but it only contains audio.

.asx

An .asx file is a metafile for Windows Media Streaming. The .asx file goes on the web server and points to the media on the streaming server. The .asx file format itself hasn't changed, but with the advent of WM7, the .wvx and .wax file extensions have been used more commonly.

.wvx

A .wfx file is a metafile that contains video and, optionally, audio.

.wax

A .wax file is a metafile that contains only audio.

MOVIE ALTERNATES

QuickTime takes a very different approach to scalability than Windows Media and RealMedia formats. Instead of making a single file that contains multiple versions of the data at different data rates, QuickTime uses multiple files at different data rates, which are switched when the movie begins playing back.

There are several drawbacks to this approach. First, the switching only takes place when the file begins playing, so there is no switching supported during playback. Second, authoring is more complex—only a few advanced compression products, like Adobe Media Exporter, support authoring the alternate movies while encoding. Third, QuickTime relies solely on the user to correctly configue QuickTime preferences to determine the data rate. So if a user sets up QuickTime on a laptop with a broadband connection at work, and then connects by means of a dial-up modem from a hotel room, QuickTime tries to transmit the broadband version of the file and either fails dramatically if it is real-time streaming or causes a very lengthy download for progressive files.

For these reasons, it is best to offer users direct links to each media file, even if you also offer a general movie alternates link.

There are some unique features of movie alternates. For one, they work with progressive files, not just streaming files. For another, they can filter in more parameters than just data rate. You can provide different versions for Mac OS and Windows users, for computers using different languages, and for computers with different CPU speeds.