Technology Manual

Contents

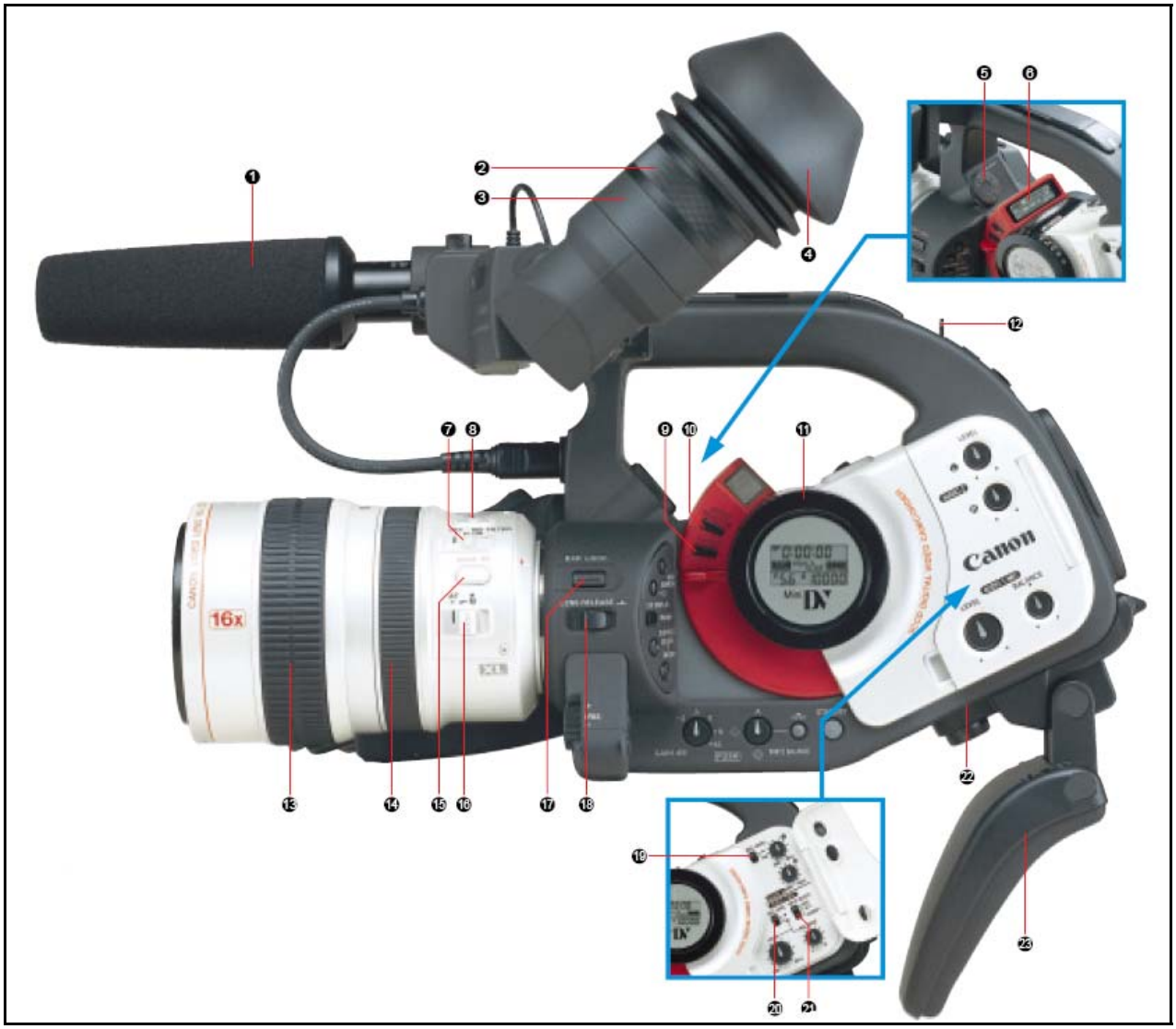
By David ‘Joe’ Edmeades

THE CANON XL1

Advantages:

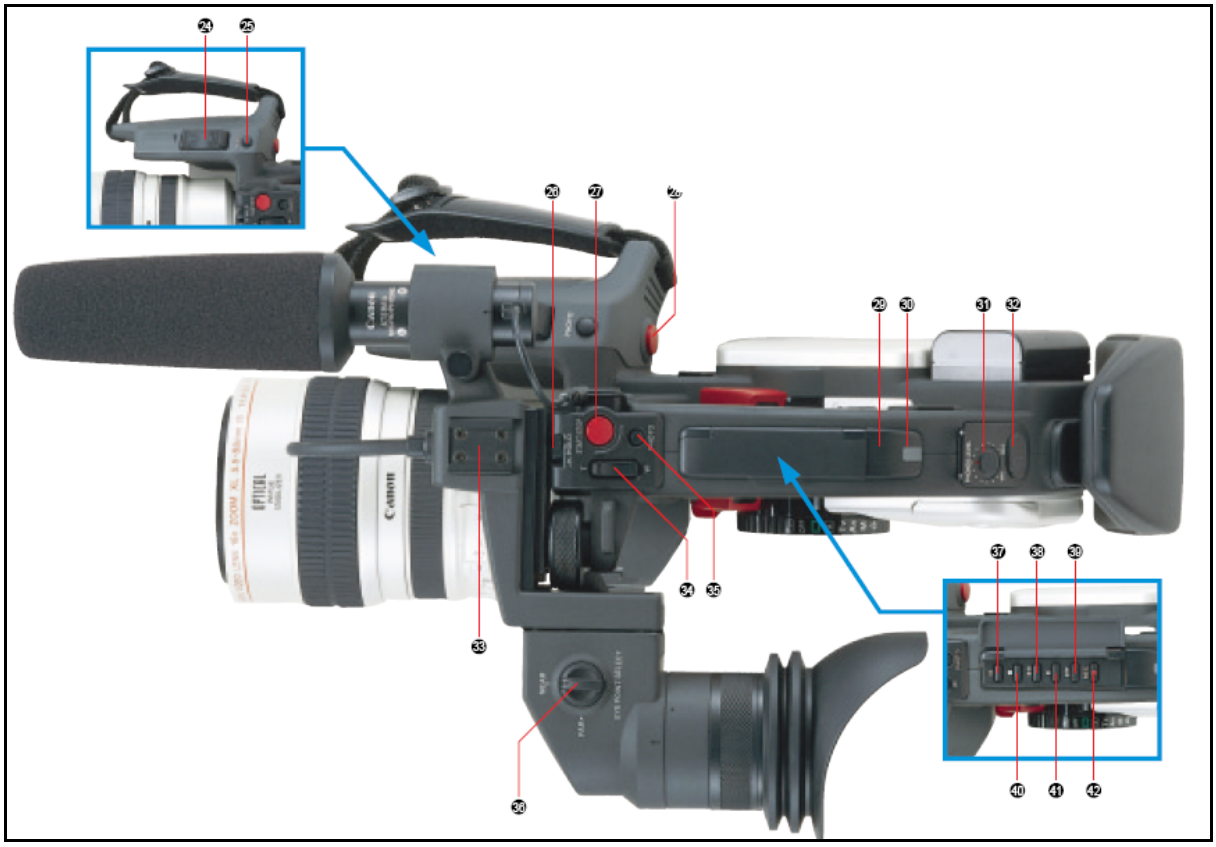
- Has a greater effect on the independent filmmaking community than any technology since the invention of digital video.
- Very robust camera and therefore ideal for use within volatile environments such as war torn hotspot areas.
- At its time of entry into the market, it was characteristic of the best picture quality for a camera as well as shooting versatility.

Parts of the Canon XL -1



1. Stereo Mic
2. View finder focusing ring
3. View finder
4. Eye cup – adjustable for use by left and right eye
5. AE shift dial – allows one to lighten or darken the image slightly; can compensate for backlit subjects or subjects with predominately dark or light tones
6. LCD panel – allows one to check the audio levels
7. ND filter*
8. Stabilizer switch *
9. Light button – gives light to the LCD panel
10. Audio Monitor – allows one to make a sound check
11. Power dial – allows one to switch between the various record programmes
12. Attachment bar – shoulder straps

13. Focusing ring
14. Zooming ring
15. AF button
16. Auto/manual focus switch
17. Exposure lock – locks settings such as iris and white balance
18. Lens release switch
19. Rec Level (audio 2)
20. Rec level (audio 1)
21. Input select
22. Shoulder pad socket
23. Shoulder pad



24. Zooming control

25. Photo button

26. Hold lever – stops the functionality of buttons on the camera eg the record button

27. Start/stop record button

28. Start/stop record button

29. Remote sensor

30. Tally lamp – it's the record light; indicates when the camera is recording

31. Head phone levels

32. Head phone socket

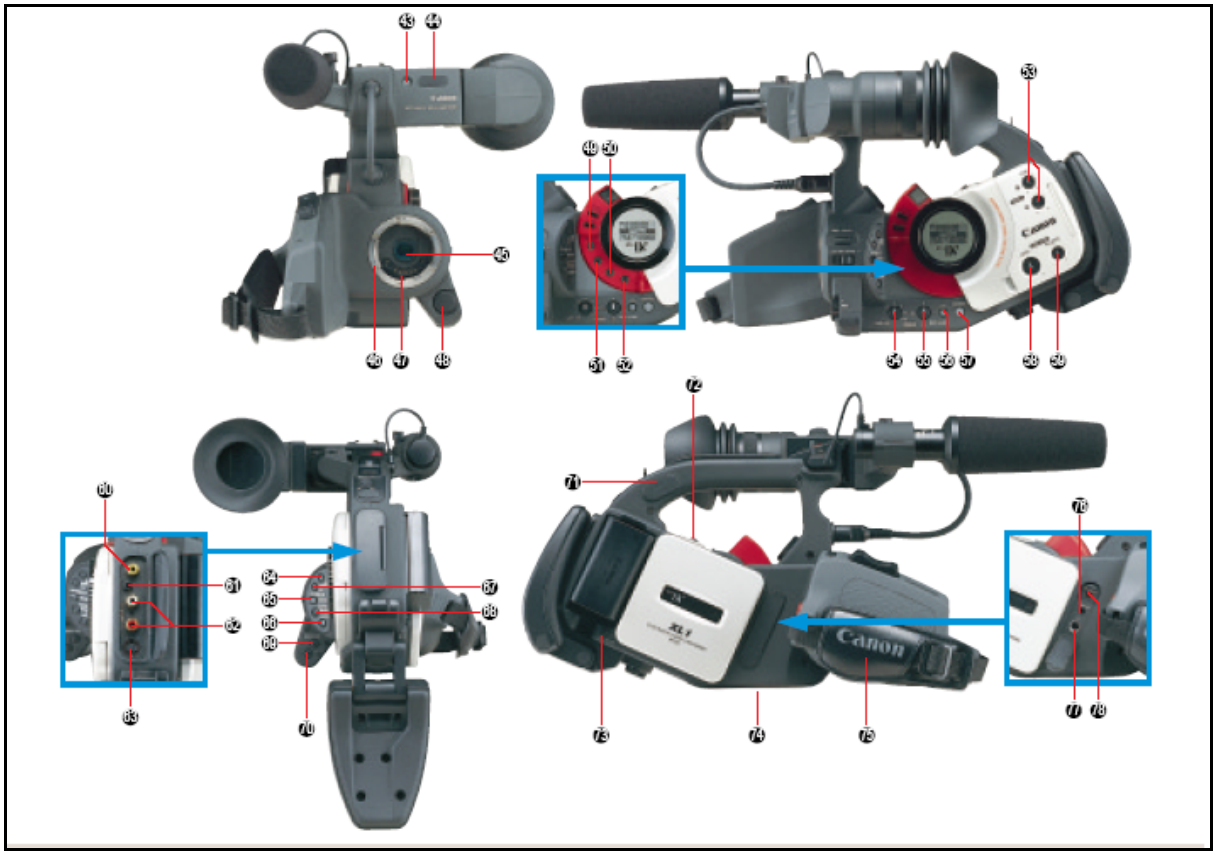
33. Accessory shoe – allows one to attach various

34. Zoom control

35. Photo button

36. Eye point select switch – allows one to adjust the screen in the view finder

37. – 42. Pause, REW, FF, STOP, PLAY, REC



43. Tally lamp

44. Remote sensor

45. 3CCD
46. Lens mount
47. Electronic contacts
48. Iris wheel
49. Menu button
50. – 52. cursor arrows
53. L/R dials
54. Gain dial -
55. white balance selector knob
56. white balance select button
57. Standby button
58. level dial
59. balance dial
60. Video terminal
61. DC out terminal
62. Audio 1 terminal
63. S-video terminal
64. Rec search + button
65. EVF display button – hides un-important camera recording displays
66. D. Effect on/off button
67. Rec search – button (review Button)
68. D. Effect select button – allows you to select 1 of 3 slow shutter effects and fade trigger
69. Shutter adjustment

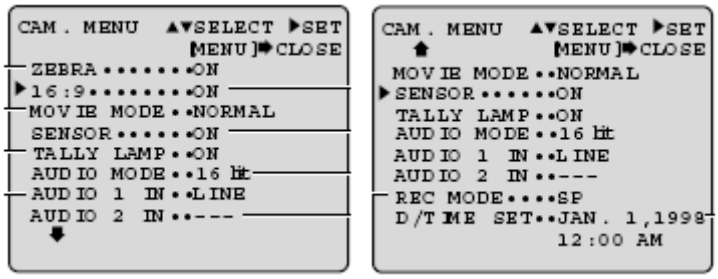
70. Shutter adjustment

Features:

- Interchangeable lens system –allows one to maximise options with a focal range of between 24 and 2160 mm; this is because of XL and EF lens
- Image stabilizers – if the camera person is a little shaky, turning the image stabilizer on allows for a steadier picture. Do not use when shooting from a tripod.

Image stabilizer ON Image stabilizer OFF

Camera Menu



- Zebra – illustrates the areas of exposure; illustrated by a series diagonal stripes that appear in the viewfinder (*The camera does not record zebra pattern)
- 16/9 effect – produces images for widescreen TVs; on a normal TV screen, the picture appears as being compressed or squashed – rather use ¾ format
- Movie – Choosing the movie mode gives 2 options: normal/frame. Frame mode is better used for high resolution stills, that is when you want to look at a video, scene by scene, free from field slippage (or flicker). Can be used when filming sport.
- Remote Sensor – connects the camera (via inferred signal) to the wireless controllers.
- Tally Lamp- is the record light which indicates when the camera is on record. In particular instances the tally lamp can be distractive to the interviewee such a close-ups or when recording through glass.

- Audio Mode – is made up of 3 different audio options: 16 bit for highest sound quality; 12 bit ST-1 for recording on 2 channels; 12 bit ST-2 for recording on 4 channels
- Record Mode – has SP (standard mode) and LP (long mode). LP extends the tape usage to approximately 90 mins. Do not record in both modes on the same tape as this can mess up the time code. When recording in LP try not use a different camera when wanting to playback as this can produce a mosaic-like noise

Power Dial

- Easy record – Here the camera takes care of all the adjustments: focus, exposure, white balance, shutter settings, 16/9 effect and others
- Auto – Here you have the option of using the camera's manual functions: focu and exposure
- Manual – Here you have total freedom of using the camera; be creative; play with the aperture and shutter speeds
- Spotlight- Here the exposure is automatically adjusted and smoothes out any contrast allowing for a glare free picture.

- ND filter – main purpose is to cut out excess light; this usually needs to happen when filming outside on bright days (or recording bright scenes) . 'ND on' flashes in the viewfinder to alert the cameraperson that the light conditions are too bright and vice versa when it is dark (ND off)

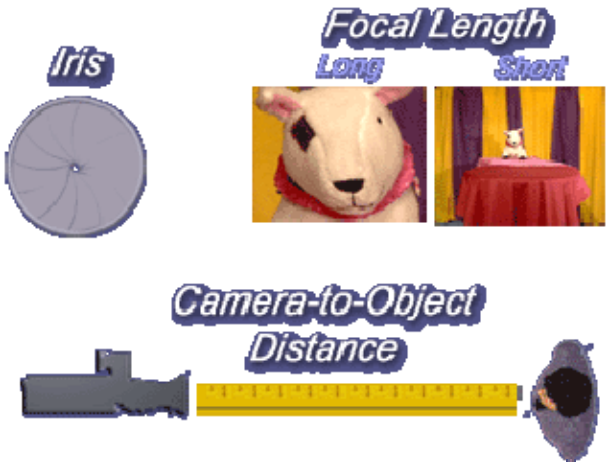
Tips:

- Change the lens as well as DV tape in a clean environment – the reason being dust particles can cause damage to the heads.
- When outside try a white balance against the clouds for better picture quality.
- Most functions such as shutter effects cannot be used during easy record programme.

Depth of Field (DOF) GOOD WEBSITE: http://smad.jmu.edu/dof/

Definition: The area in which objects located various distances from the camera are in focus; Characterized as either shallow or great.

3 ways of manipulating DOF:



Iris - Device inside the lens that controls the amount of light entering the camera. F-stops are the unit of measurement indicating the width of the iris opening. The smaller the F-stop number, the bigger the opening. ***The larger the iris opening, the shallower the depth of field. The smaller the iris opening, the greater the depth of field.***

Focal Length - The distance from the Optical Center of the lens to the front surface of the camera's Target, measured in millimeters. Changing focal length is known as zooming and is done via the Zoom Ring. ***The longer the focal length, the shallower the Depth of Field. The shorter the focal length, the greater the Depth of Field.***

Camera-to-Object Distance - is best understood via the numbers on the focus ring. When the focus ring is on 10, any object 10 feet away from the camera will be in focus. ***The greater the distance between the camera and person/object, the greater the Depth of Field. Conversely, the shorter the distance between the camera and person/object, the shallower the Depth of Field.***

GREAT DOF: One can achieve a great depth of field by using a great camera-to-object distance, a short focal length and/or a small iris opening (high f stop number)

SHALLOW DOF: One can achieve a shallow depth of field by using a short camera-to-object distance, a long focal length and/or a large iris opening (low f stop number)

FOCUS: Focus can't be fixed in post production, so it has to be right. It's all about the distance between the camera and the subject. If either of these moves, you may have to adjust the focus. You must also consider the implications of using manual or auto focus. To focus something close turn the dial anti-clockwise; to focus something far turn the dial clockwise.

Camera Movements and Composition

Movements – cut down the amount of shake by shooting on wide. One can also make use of the stabiliser option on the camera. When beginning to shoot make use of a tripod and once you've built up your confidence then beginning to go hand-held and play with movements. Movement in the frame and in camera makes sequences more interesting. But it can cause problems. All camera moves should be motivated - either to follow action or help the story. Particular care is needed with handheld work - a skill which comes with practice

Movements include: Pans, tilts, zooms and tracking. Use the right movement which would be best in a particular situation. Sometimes incorporate a few camera movements together in a sequence, for example a pan and zoom out. When doing this think about detail and the speed (create a soft beginning then speed up).

Tip: bean-bags come in handy for creating a stable shot when faced by a difficult situation.

Composition – Decide on a frame for close-up, medium and wide and then stick to those framings for the whole filming process so to create consistency between different shots in different sequences.

Shooting sequentially also helps cut cleanly together: five shot rule – close-up on hands, then on face then a wide shot, then over the shoulder shot and then another shot from different angel.

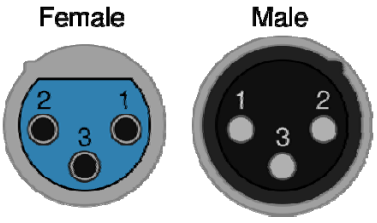
CABLES

In TV we do not used the term ‘Cord’ but cable.

BNC - is a very common type of RF connector used for terminating coaxial cable. Used in analog video signals and connects the video machine to monitor. It is an alternative to the RCA connector when used for composite video on commercial video devices.

RCA – (Radio Corporation of America) is a type of electrical connector that is commonly used in the audio/video market.

XLR – connector is an electrical connector design. XLR plugs and sockets are used mostly in professional audio and video electronics cabling applications. Home audio and video electronics normally use RCA connectors.

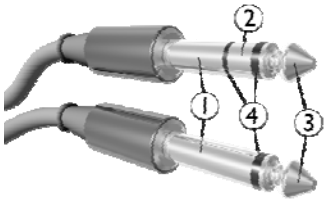


1 Chassis ground (cable shield)

2 Normal polarity ("hot")

3 Inverted polarity ("cold")

Jack - A TRS connector, also called an audio jack, phone plug, jack plug, stereo plug, mini-jack, or



mini-stereo, is a common audio connector.

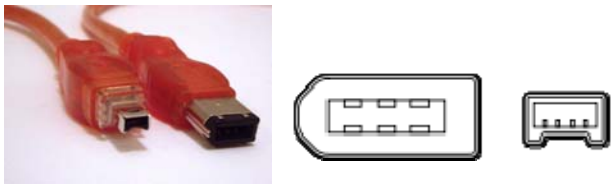
1. Sleeve: usually ground

2. Ring: Right-hand channel for stereo signals, negative phase for balanced mono signals, power supply for power-requiring mono signal sources

3. Tip: Left-hand channel for stereo signals, positive phase for balanced mono signals, signal line for unbalanced mono signals

4. Insulating rings

FireWire – or the IEEE 1394 interface (although the 1394 standard also defines a backplane interface) is a serial bus interface standard, for high-speed communications and isochronous real-time data transfer, frequently used in a personal computer (and digital audio and digital video). The interface is also known by the brand names of FireWire (Apple's name) and i.LINK (Sony's name).



The 6-pin and 4-pin FireWire 400 Connectors

Pathways in Video - ***Composite video*** is the format of an analog television (picture only) signal before it is combined with a sound signal and modulated onto an RF carrier. The RCA connector is the most common connector for composite video. ***Component video*** is a video signal that has been split into two or more components. In popular use, it refers to a type of analog video information that is transmitted or stored as three separate signals. The various RGB (red, green, blue) analog component video standards (e.g., RGBS, RGBHV, RG&SB) use no compression and impose no real limit on colour depth or resolution, but require large bandwidth to carry the signal and contain much redundant data since each channel typically includes the same black and white image.

CANON XL1 and AUDIO

Mic Types - There are three basic types of microphone:

Personal clip mic:

Mounted on the chest, discreetly visible in shot, sensitive to wind noise and body movement.

Gun (Rifle):

Mounted on a boom, picks up sound from only one direction, can stay out of shot, sensitive to wind and handling noise.

Stick (hand-held):

Handheld close to the sound source, usually visible in shot, robust and quite resistant to wind noise.

Mics connect to the camera through a cable or a radio link.

Radio Mics

Radio mics offer great freedom and flexibility in actuality filming, but are complex pieces of kit: you have a transmitter and a receiver to consider as well as an unpredictable radio link.

A cabled microphone is plugged into a transmitter. The audio is transmitted via a radio link to a receiver that plugs into the camera. The transmitter has sockets for the mic and for the aerial. The receiver will have one or two fixed aerials and a socket for the cable that runs to the camera.

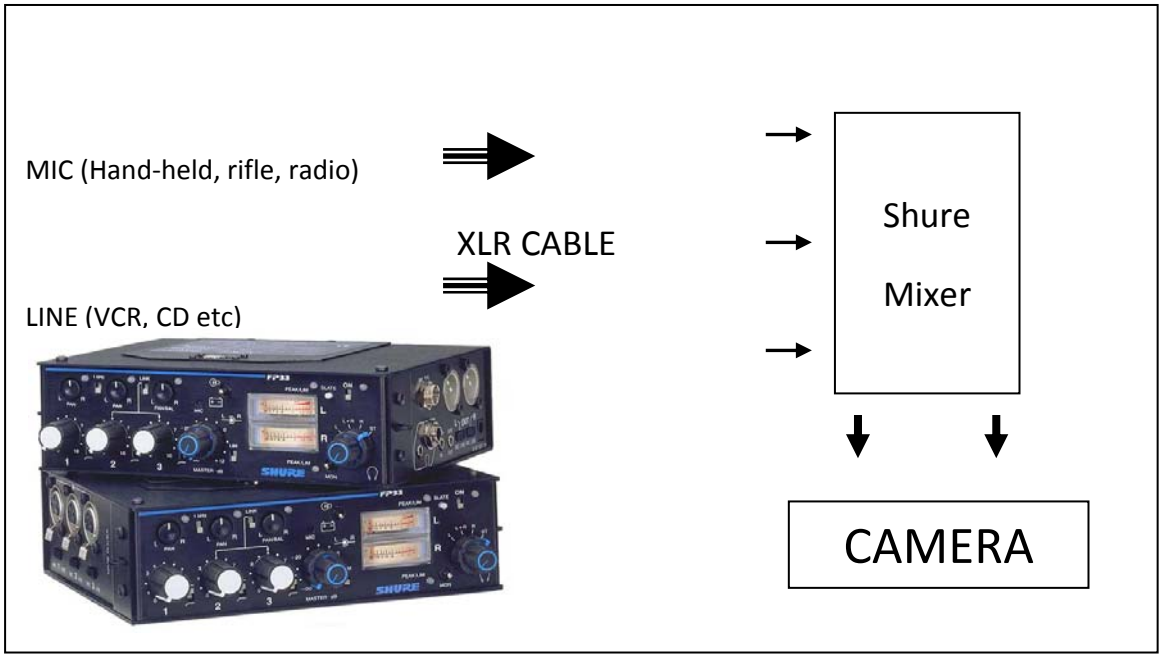
What Mics are good where?

- Stick mics are good for vox pops.
- Use radio mics if you are far from a speaker and have time to set them up.
- Radio mics can help keep your contributors in the story even when they're not in shot.

- Gun mics are useful for less controlled situations.
- Gun mics should have a windshield and rubber suspension system.
- Consider mic combinations: eg a gun mic picking up the sound from what's in shot and a radio mic picking up your key contributor.

Sound Mixing – Pathways

- Connected the mic to the Shure mixer via a XLR cable – plug it into mic channel 1; do not plug a line into the mic input, switch it across
- One can then check the levels received by the mic by plugging headphones into the Shure mixer and monitoring the sound as well as checking the metre levels (keep it at -4)
- Plug an XLR cable into the input of the camera and into the output of the Shure mixer (make sure you calibrate the audio between the Shure mixer and the camera - should be -4 on Shure mixer and on certain camera's -12)
- Shure mixer has abilities such as base cut, sweeten sound and mix/gain



SCRIPT WRITING

2/3 columns

- Audio, Video, Character
- Time, Location
- Audio effects

Paul's Method: (Abstract/Concrete)

Abstract	Concrete
Come up with an abstract idea from research and background reading: Hunger Crime Violence and Abuse	Narrow down the abstract topic into a concrete story. E.G. Hunger – Food lines, begging Take this into the field; go in open ended and anticipate shots. Get case studies – people involved in your idea.

LIGHTING

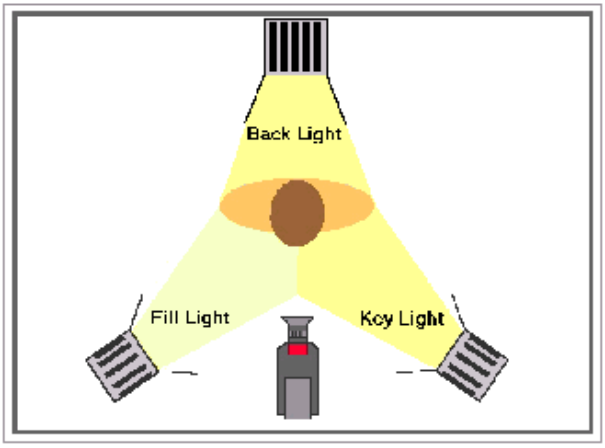
Hard light comes from a small point source such as the sun or a closed faced lamp and produces hard shadows. A hard light source is controllable and easily directed and an image lit by hard light is usually high contrast and looks dramatic.

Soft light comes from a large source such as a cloudy sky, large window or a lamp with a diffuser and produces soft shadows. The spread of light is not easily controlled and an image lit by soft light is normally less dramatic and low contrast

High Key lighting is where the background and the foreground are lit at similar lighting levels creating a less dramatic mood.

Low Key Lighting is where the background is lit at a lower level than the subject producing more contrast and a dramatic effect.

Three-point lighting - is a standard method used in visual media such as video, film, still photography and computer-generated imagery. By using three separate positions, the photographer can illuminate the shot's subject (such as a person) however desired, while also controlling (or eliminating entirely) the shading and shadows produced by direct lighting.



- ***The key light***, as the name suggests, shines directly upon the subject and serves as its principal illuminator; more than anything else, the strength, colour and angle of the key determines the shot's overall lighting design.
- ***The fill light*** also shines on the subject, but from a side angle relative to the key and is often placed at a lower position than the key (about at the level of the subject's face). It balances the key by illuminating shaded surfaces, and lessening or eliminating chiaroscuro effects, such as the shadow cast by a person's nose upon the rest of the face. It is usually softer and less bright than the key light (up to half). Not using a fill at all can result in stark contrasts (due to shadows) across the subject's surface, depending upon the key light's harshness.
- ***The back light*** (a.k.a. the rim, hair, or shoulder light) shines on the subject from behind, often (but not necessarily) to one side or the other. It gives the subject a rim of light, serving to separate the subject from the background and highlighting contours.

Glare - Shining a bright light directly into a subject's eyes will not make them tell you wartime secrets but instead will make them feel uncomfortable. Using the preferred 30-45 degree key light angle or diffusing the key light should solve this problem. It is both considerate and good practice to warn the subject before turning on a lamp that is pointed in their immediate direction so that they aren't taken by surprise.

Flare - Pointing any lamp into the camera lens will probably produce lens flare. If this effect isn't desired internal lens reflections will be produced and the resulting image will be less sharp and may not be useable.

Common mistakes:

- Forgetting to take the subjects' natural skin tones into consideration when using CTO (colour temperature orange) and CTB (colour temperature blue) gels. A subject with dark skin will look unwell if lit with blue/cold lights.
- A subject with lighter skin will not suit being lit with orange/warm lights.
- Accidentally using a stronger colour effect gel to light a subject.
- Using the least powerful source of light as your key light. Make sure your key light is the most powerful light.

Compression and Codec

A codec is a device or program capable of encoding and/or decoding a digital data stream or signal. The word codec may be a combination of any of the following: 'compressor-decompressor', 'coder-decoder', or 'compression/ decompression algorithm'.

A video camera's analog-to-digital converter (ADC) converts its analogue signals into digital signals, which are then passed through a video compressor for digital transmission or storage. A receiving device then runs the signal through a video decompressor, then a digital-to-analogue converter (DAC) for analogue display. A "codec" is a generic name for a video conferencing unit.

Uncompressed video files are too large and the data rates are too high to transport effectively over a local area network or the Internet, so you need to compress them. Compression works by summarizing a sequence of images and sounds as efficiently as possible. Video that has been compressed doesn't provide an identical representation of the source file back to the user—the data rates would be far too high. Instead, the encoded files describe the important details of the content as tersely as possible while still providing a reproduction that, to the human sensory system, provides the experience of the original as accurately as possible. One popular instance of compression with which many computer users are familiar is the ZIP file format, which, as well as providing compression, acts as an archiver, storing many source files in a single destination output file.

Compression is useful because it helps reduce the consumption of expensive resources, such as hard disk space or transmission bandwidth (computing). On the downside, compressed data must be decompressed to be used, and this extra processing may be detrimental to some applications.

Two types of compression: SPATIAL AND TEMPORAL

Spatial compression, also called intraframe compression, affects only a single frame at a time. It finds redundancy within a frame—either in areas of flat or similar colors, or areas of a frame that look like other areas of the frame—and saves space by encoding these similar areas by reference, rather than by a literal description of color attributes for each and every pixel. Most compressors only use spatial compression.

Temporal compression, also called interframe compression, adds the ability to use other frames as a reference for the current frame. Temporal compression encodes only the changes from one frame to another (with the exception of key frames).

Frame types and compression

A keyframe, or I-frame, is a complete image that is compressed using intraframe compression. An I-frame isn't based on any other frames in the file. The first frame of a movie is always an I-frame.

A delta frame is compressed using interframe compression and contains only those portions of the adjacent frames that are different. There are two main types of delta frames: P-frames and B-frames. The content of a P-frame (predictive frame) is based on the previous frame; the content of a B-frame (bi-directional frame) is based on the previous and subsequent frames.

Audio Compression:

The most fundamental factor in audio is sampling rate, which is measured in Hertz (Hz), or cycles per second. Reducing the sample rate and number of channels can reduce the data rate.

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

Typical sample rates for common use.

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

Channels - most audio from computers is either mono with a single channel or stereo with two channels. Low bit rates generally use mono because it requires fewer bits.

Compression efficiency

So, how does someone compare codecs? The fundamental measurement is compression efficiency, which is defined by how many bits are required to reach a particular quality level. When improving compression efficiency, you can choose to lower the data rate while keeping the quality the same, increase the quality while keeping the data rate the same, or pick a point in between.

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. It's with aggressive data rates and difficult content that compression efficiency makes a difference.

Content for compression:

When you create content for compression, there are a variety of techniques that you can apply to produce better results. You can apply these techniques during preproduction, production, or post-production.

Preproduction - In preproduction, 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 - During production, there are techniques you can use to produce video that compresses well:

Interlaced versus progressive scan

Camera motion

Shutter speed

Backgrounds

Depth of field

Post-production

Static versus moving images

Motion Blur

Anti-aliasing

Progressive rendering

Capturing video: choosing formats and connections

The type of video, or format, and to a lesser extent the connection type you select to capture content, can dramatically affect the quality of the video on the computer. It's always desirable to start with the highest possible quality video and audio signal. Today's editing software, such as Adobe Premiere® Pro, and many compression software tools, can capture content in a variety of ways. Video can be captured from analog or digital sources. A list of the common video signal formats follows, along with the popular types of cables and connectors for transmitting them:

* For **Analog, Composite, Component** see above under 'Cables'

Unbalanced audio - This type of audio connection consists of a single wire that carries the signal, surrounded by a grounded shield. It is used commonly in consumer audio products because the connection and circuitry are less complex. The downside is that unbalanced connections are more susceptible to interference, so they are not often used in professional applications.

Balanced audio - This type of connection consists of two wires, which serve to balance the signal, and a shield. A balanced connection is far less susceptible to interference, so it is possible to maintain high quality with long cable runs. Balanced audio normally uses the XLR, or three-pin, locking connector, which provides a much tighter and robust connection than the connectors used for unbalanced audio. Once again, longer cable runs and a locking connector form the basic standard for a professional connection.

Digital formats

Multiple digital formats are available in the video industry. Many of these formats are related to compression and not acquisition or filming with a digital camera.

DV25 (DV) This format is most commonly known by the physical connection standard it uses, IEEE-1394 or FireWire, however it uses only a fraction of the data rate and speed available in the IEEE-1394 connection standard. Both the audio and video signals are carried on a single FireWire or IEEE

1394 cable (the Sony variation of which is known as i-Link). The cable also carries device control signals that allow the computer to control the DV camcorder.

SDI (Serial Digital Interface) SDI is a high-end, professional format for digital signals. The SDI format, technically known as CCIR-601 or 601, is superior in quality to component analog video and is the standard in professional and broadcast television. Because it is digital and uncompressed, it can be edited and copied many times with no detectable loss of quality.

Choosing the right capture codec

When you capture content, you must choose an appropriate 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.

Exporting video

E**xporting to file** - it is useful to export an intermediate file from the timeline and use the exported file for further processing. Then **choose whether to preprocess or to avoid rendering**. When to apply preprocessing (described in the next section): during the rendering phase or later. Preprocessing during rendering generally results in a smaller file, but adds more rendering time. It also means you can't use an encoding tool for special operations, like inverse telecine. Then **choose a file format for rendering.** The most common formats are QuickTime and AVI; both offer good-quality intermediate codecs. Then c**hoose a codec for exporting.** When you export an intermediate file, 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.

Understanding preprocessing

Preprocessing is the middle step of video compression and involves transforming the decoded frame of the source video into the optimized frame given to the codec. The goal of preprocessing is to transform the video into the final format. It's also very important for quality, and getting it right can dramatically improve the quality of the final video. A well preprocessed video can look better than the same source file poorly preprocessed, but can be encoded at twice the data rate.

Deinterlacing video - The most basic and critical form of preprocessing for the web is deinterlacing. Most video is produced and edited as interlaced. 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

Cropping is excluding areas of the source frame from inclusion in the output frame. Content composed for video normally confines critical elements to what are called safe areas. The safe areas exclude the edges of the screen, which may be cut off or distorted on some televisions (especially older ones). In some digital video editing applications, you can crop an image using a filter. In others,

such as After Effects, the easiest way to crop an image is to scale the video up so the unwanted edges are no longer part of the frame. If you want an asymmetric scale, you can move the anchor point of the video as needed.

Scaling

Scaling is resizing the cropped source rectangle to the proper output frame size, for example, going from a 720 x 480 source frame to a 320 x 240 output frame for web video. Scaling up on either axis forces a video editing application to make up data that's not in the source. It's always preferable to scale down on both axes if possible.

Noise reduction

Noise reduction encompasses a variety of techniques to remove noise, especially grain, from an image, making it easier to compress. Very simple noise reduction algorithms are just blurs—they can hide grain, but can make the image quite soft as well. The commonly used Median filter is a good blur for noise reduction. More advanced algorithms try to blur only the parts of the image that have grain and may take advantage of differences among frames.

Image processing

Image adjustment is the process of using controls, such as those found in image editing applications, to change the overall image. Because different colour spaces are used by different codecs, image adjustment used to be required for most projects.

Audio processing

Audio may only get a fraction of the bits that comprise video, but it is half the experience. While audio processing is generally easier than video processing, it is important to correctly process both.

Choosing a compression format

Depending on the project, picking the correct format can be an easy or a difficult decision. Sometimes the customer mandates the format; other times the person performing the compression has to make a recommendation. Sometimes the project requires features that are only available in a particular format. Perhaps the requirements haven't been determined. After you choose a format, you need to determine the versions of players that support the format. This section guides you through some questions to ask when choosing a format.

• **Features** Often the biggest determining factor of a platform is the features that users need. If a format can't meet the project requirements, it's obviously not an option. In every project, different features vary in their degree of importance. Compression efficiency is almost always critical. Real-time streaming scalability is another major feature.Compression Primer

• **User base** Depending on the project and audience, user base may be very important. With most advertising content, users are unlikely to download a new player or codec just to watch a marketing clip. But for compelling content, users may consider making sacrifices. For example, Apple logged

several million downloads of QuickTime in the 72 hours after a very popular movie trailer was released.

• **Platforms** Some formats are only available on a single platform or have different features depending on the type, or the version, of the operating system. Most of the modern media players are available for at least Mac OS® and Windows; some are available on Linux® and other operating systems. If you require very broad compatibility, an older standards-based format, like MPEG-1, might be appropriate.

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. While it can be tempting to offer variants in five formats at four data rates each, it is generally better to focus on as few formats as possible and make three optimized files instead of twenty low-quality files.