Canon Rebel T2i (EOS 550 D)

Quick Start Guide

For Video Recording

v. 01 2020

This is a Beginner's Guide

- This is a beginner's guide to shooting video with a DSLR camera.
- Although this is a cheaper model of DSLR, the principles demonstrated for determining exposure will be the same for more expensive models. Some of the same image problems exist in the high-end DSLRs as well.
- There are quick start guides for other DSLR models on the CDA website, but they skip over the information for the novice.
- This guide is a good place to start if you are new to video recording.

- The Canon T2i is a 18 Megapixel entry level DSLR (released in 2010).
- It records HD 1080p video to an internal SD card.

- This guide will explain the basic procedure for shooting video and recording audio while making reference to specific equipment in the CDA EV depot.

- In this guide all of my examples are from the Canon T2i. Subsequent generations of Canon Rebel cameras will have similar, if not identical, menus and controls. Later Rebel models made significant improvements: continuous auto focus during video recording for example. The majority of the Canon Rebel cameras in the CDA depot are T2i models.

When to use this camera

- For video recording the Canon T2i camera is better than using a phone but not preferable to an actual video camera.

- Advantages of the Canon Rebel DSLR: relatively simple to use, a good lens that can also shoot close-up details, proper image exposure and focus controls
- Disadvantages: limited video recording time (a 12 minute maximum shot length), no audio recording controls

Video vs Still Image

- Since this is a still camera with a video option, you may be tempted to record video with the camera in a vertical position. Never do this (unless you have a special vertical video installation in mind). Keep the camera horizontal. The video image is always wider than taller.
- Don’t expect the video resolution to be as fine as still images. HD video has a resolution of 1920 x 1080 pixels. This is like shooting with the small JPEG still image option on the camera.
- Although it is a 18 megapixel camera, video recording does not use all of these pixels on the sensor. The video image will be noisy in low light (high ISO) situations.

Basic Operation and Essential Menu Settings

In the following examples, you can see the placement of the menu setting by looking directly at the LCD on the T2i.

SD card slot

This model comes with a Class 10 8 GB SD card. This will record 22 minutes of HD video. Video can be recorded with a Class 6 SD card or higher.

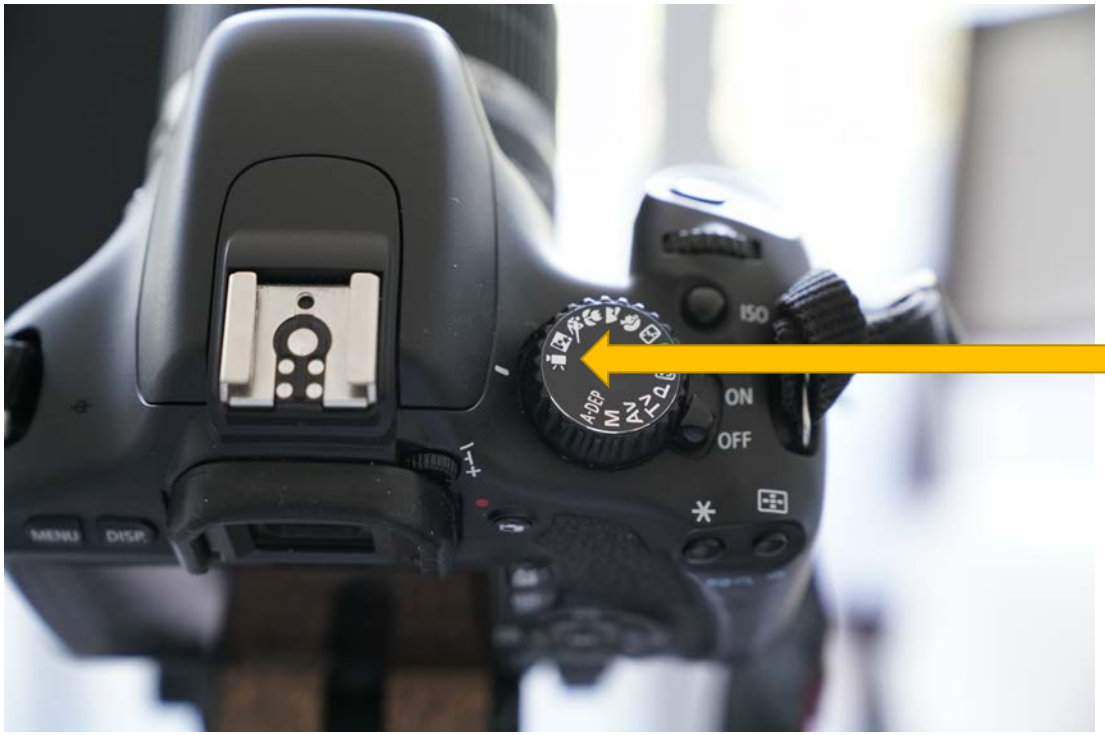
Buffer Memory Indicator

You'll notice that when you are recording there is a buffer (memory) indicator on the LCD. If the card is too slow to record video, the recording will stop and the indicator will have reached the top.

Battery

- Turn on the camera to see the battery charge level.
- The battery will last about two hours and takes about the same amount of time to charge.
- Turn off the camera when you are not using it to save battery power.
- There is no AC adapter supplied for this camera.

Movie mode



Turn the dial on top to movie recording mode.

Lens Controls

On the 18-55 mm zoom lens there are two rings for focusing and zooming.

There is a switch to enable auto or manual focus and a switch for image stabilization.

Turn off stabilization when the camera is on a tripod.

Holding the camera

To minimize camera shake, turn stabilization on when you are hand holding the camera.

Try to hold the camera as steady as possible by bracing it against your body or holding one hand underneath the camera (as shown).

It may help to keep a tripod shoe attached to the bottom of the camera to give it some extra weight.

Tripod Mounting

It helps to have a quarter handy to mount the tripod shoe on the bottom of the camera.

Tighten until snug.

Photo vs Video Tripods

- There are different types of tripods. Photo tripods are usually lighter and simply designed to hold the camera steady.
- Video tripods have larger heads that allow for fluid movement when panning or tilting.
- Select the tripod that is appropriate for your use. If your shots are static, then a photo tripod will be good enough.

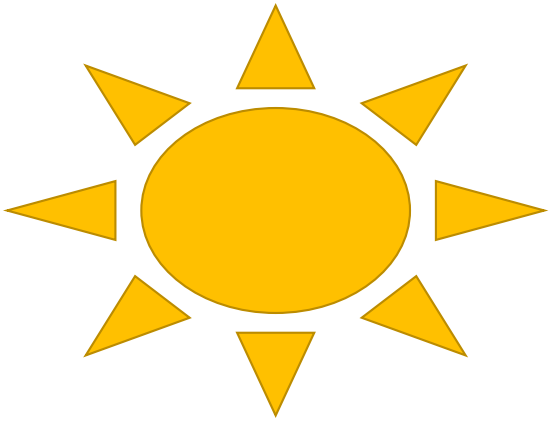
Movie Record Button vs Shutter Button

Movie Record Button

Shutter (photo) and
Auto Focus button
(when pressed halfway)

Overheating

- When shooting in bright light, the camera can become overheated and the recording may stop.
- This is a normal malfunction for this model. If this happens, just wait for it to cool down.



Format the SD card

Go into the “wrench” camera menu.

Reformat the SD Card to erase any images or videos that may be left by the previous user.

Set the Movie Recording image size and frame rate

1920 x 1080 30p is the most common HD video image size and frame rate in North America.

About video image sizes and frame rates:

- 1920 x 1080 is the image size in horizontal by vertical pixels. This is the size of HD video.
- 24 and 30 are the frame rates: 24 frames or 30 frames per second (fps).
- In addition to “fps”, frame rates can be expressed as “p”, to indicate progressive scanning common to all new cameras. ”30p” means ”30 fps”.
- Choose 1920 x 1080 24 for talking head videos
- Choose 1920 x 1080 30 fps for videos with motion

More about NTSC frame rates

- 24 and 30 fps are the standard frame rates in North America and Japan where we use the NTSC video system. The majority of other countries in the world use the PAL video system. They record video at 25 fps.
- In fact, the camera is recording at 23.97 fps and 29.97 fps.
- NTSC cameras do not advertise this actual frame rate but confusingly round it up to 24 or 30.
- When you edit NTSC video you will see one of these actual frame rates in the sequence or timeline settings in your editing software and when you export the video from that timeline.
- 23.97 and 29.97 fps are the actual frame rates for NTSC video used by TV and the internet.

Other Image Sizes and Frame rates:

When recording 1920 x 1080 video, the Canon Rebel cameras can only record 12 minutes of continuous video.

If you require a longer recording without interruption, you may shoot for 24 minutes with the 640 x 480 option. The image quality will be lower and fine image details may be lost. The image will also be more square shaped (4.3 instead of 16.9 aspect ratio).

1280 x 720 also records only for 12 minutes continuously because it is recording at a higher frame rate.

Recording Times by Image Size
This chart gives you an idea of the file sizes for video.

Movie-recording Size		Total Recording Time		File Size
		4GB Card	16GB Card	
[1920x1080]	30	12 min.	49 min.	330 MB/min.
	25			
	24			
[1280x720]	60	12 min.	49 min.	330 MB/min.
	50			
[640x480] [Crop 640x480]	60	24 min.	1 hr. 39 min.	165 MB/min.
	50			

Changing the Video System

If you see 1920 x 1080 25 or 50 in the movie recording menu then you must change the video system menu setting from PAL to NTSC.

Only record in PAL frame rates if the video is destined for distribution in countries that support the PAL video system.

Auto or Manual Movie Exposure?

I recommend using manual exposure for video recording.

This is the only way to control shutter speed.

However, here follows an overview of both approaches.

Auto Exposure

Indicates overexposure

Here is an initial auto exposure performed by the camera. There are problems.
First, the image is overexposed.

Second, the camera has selected a high ISO of1600 that will produce image noise. Try to avoid any ISO above 800.

Third, the shutter speed is below twice the frame rate. This will blur motion.

This is a complete failure!

Compensating for Auto Exposure

Holding the AV button on the back of The camera and turning the dial adjusts exposure compensation. When the dial lines up on the middle, the optimal exposure has been reached.

You can see that this compensation has changed the ISO to 800. Great! But the shutter speed remains the same.

I am shooting at 1080 30p and the shutter speed is below twice the frame rate. The shutter speed should be 60 ($1/60^{th}$ of a second).

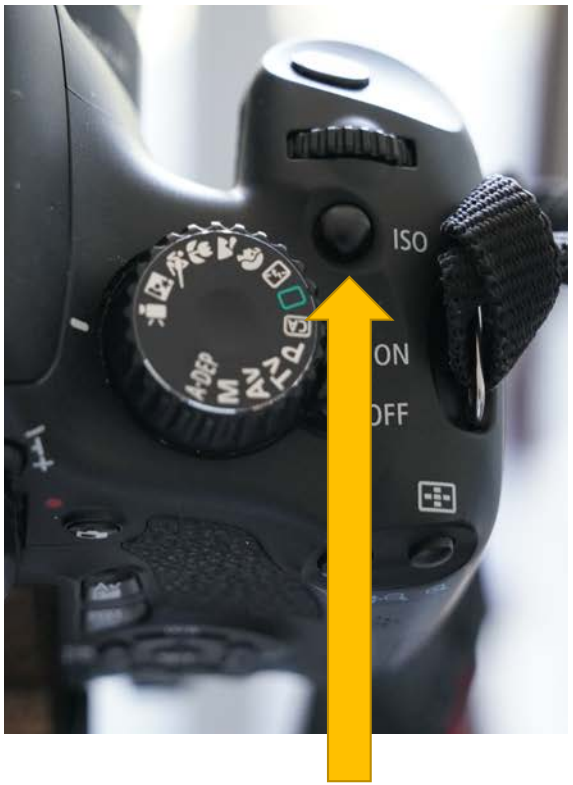
Why manual exposure works best:

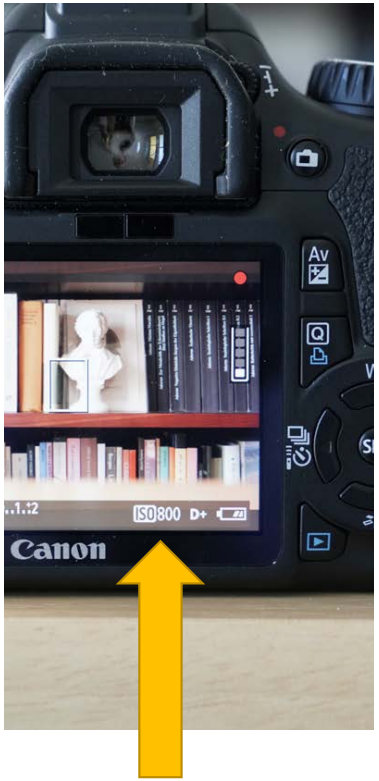
- Using manual exposure is the only way to have control over the shutter speed.
- Auto exposure will change your shutter speed at random with varying results. You may not notice the effect in a talking head video but the shutter speed can greatly affect how movement appears in your video.
- Once the shutter speed is below twice your video frame rate, all motion will be blurred. Once the shutter speed becomes very high (1/250th of a second and above), motion may take on a staccato or clockwork appearance. This has to do with image motion blur.

Manual exposure settings:

- Determine your exposure manually in this order:
- ISO (try not to use an ISO above 800 ISO)
- Shutter Speed (usually twice the frame rate and never lower)
- Aperture (f stop)
- White Balance

ISO adjust





To adjust ISO, hold down the ISO button and turn the dial on top of the camera.

800 ISO is the highest ISO you want to use with this camera. The lower the ISO, the less chance that you will have image noise.

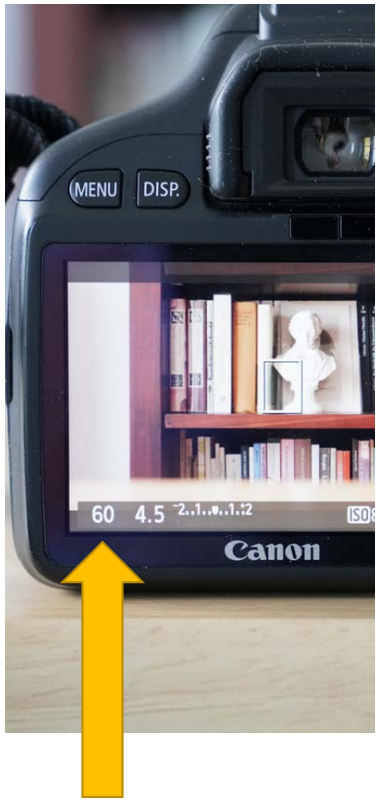
About ISO

- ISO adjusts the camera's sensitivity to light.
- As you lower the ISO, the sensor becomes less sensitive.
- Usually ISO 100 or 200 will work for outdoor scenes in daylight.
- ISO 400 and 800 can be used indoors.
- Any ISO number above ISO 800 will make image noise very noticeable.

ISO and Image Noise

- You will not necessarily see image noise on the tiny LCD screen on the back of the camera.
- If you find that you do not have enough light at the ISO 800 setting, then make sure that your lens aperture is set to be as open as possible.
- On this camera, that would be f 3.2 at the most wide angle focal length (18 mm) and f 5.6 at the most telephoto focal length (55 mm). An aperture opening of f 3.2 lets in a lot more light than f 5.6! If you still don't have enough light, then get some: artificial or otherwise!

Shutter Speed



To adjust the shutter speed, move the dial on top of the camera.
The shutter speed is the number in the bottom left of the LCD.
Here it reads 60: meaning 1/60 th of a second.

The standard shutter speed is twice the video frame rate.

About Shutter Speed

- The shutter is the amount of time that each frame of video is exposed. Shutter speed is expressed as a ratio and is abbreviated on the camera as a single digit. 60 on the camera means 1/60th of a second.
- **The standard shutter speed is twice the video frame rate**. When recording at 30 frames per second then each video image (all 30 images per second) will be exposed for 1/60th of a second.
- When recording at 24 fps, the shutter speed on this camera will be 50 (not 48). DSLR cameras rarely have the 1/48th of a second option.

When to change shutter speed:

- I only recommend deviating from the rule of the shutter speed remaining twice the frame rate in the following situations:
- One: You are outside on a bright day, you are already shooting at the lowest ISO possible (100 ISO), at the smallest aperture opening possible (f32) with image compensation and the image is still overexposed! In this case, increasing the shutter speed to a higher number will cut light and decrease exposure. A better option is to use an ND filter (not included in this kit).
- Two: for a special motion effect.

Shutter Speed Distortions

In the following two images you will see an example of a type of error that can occur when shooting video of an object in fast motion at high shutter speeds.

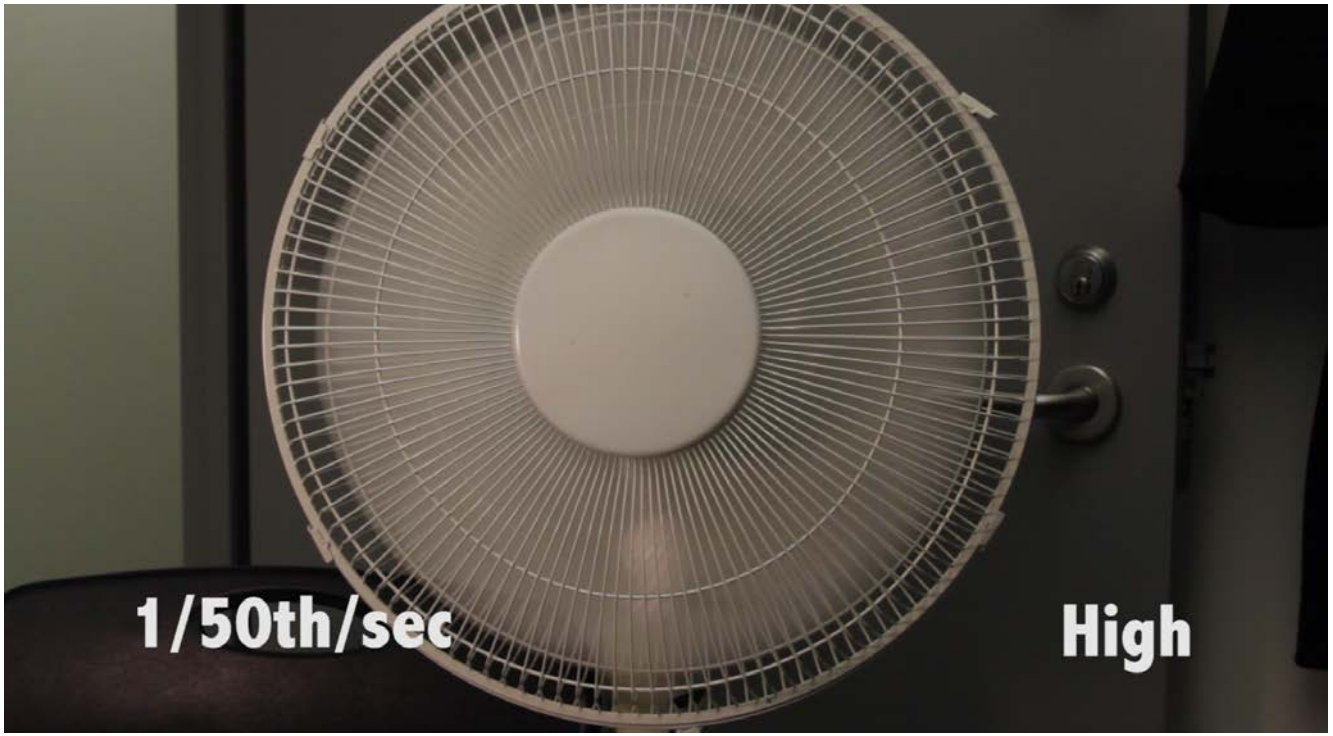
Notice how in the second image, the blade of the fan is distorted.

This distortion is caused by the electronic shutter of the camera.

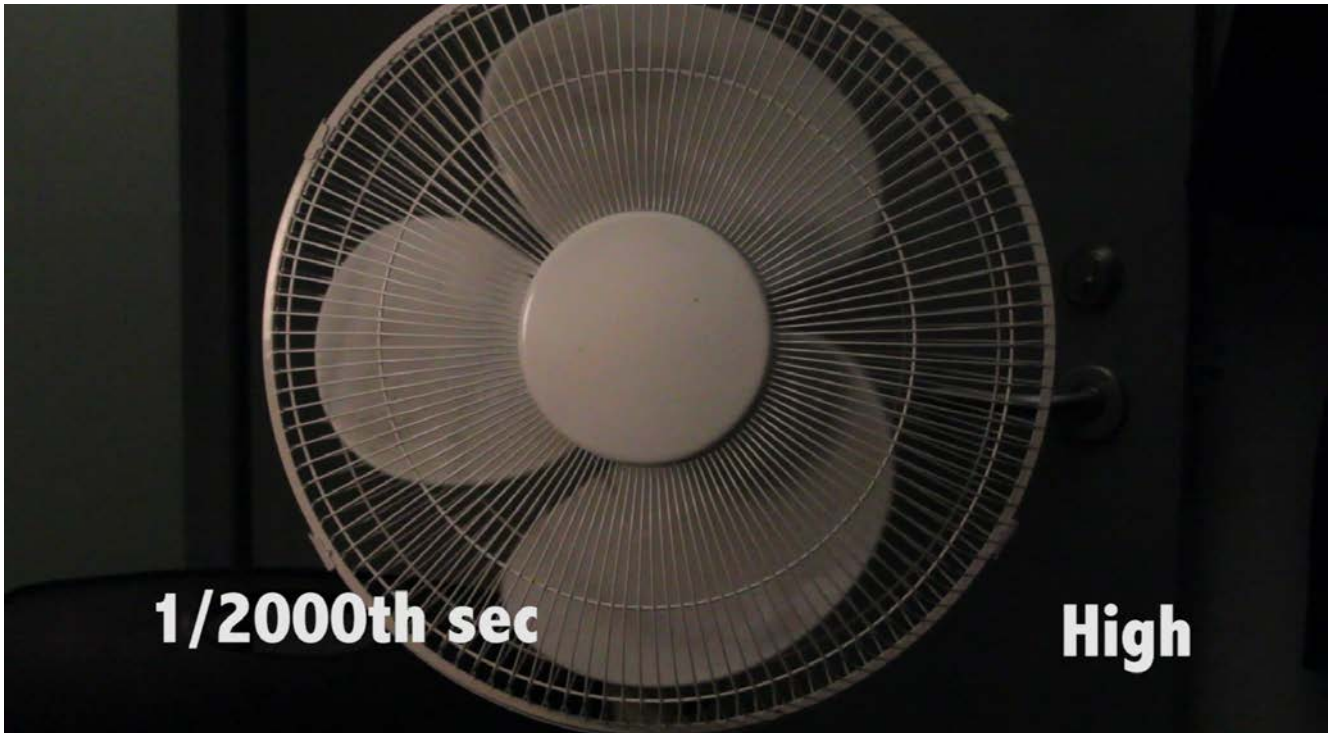
The electronic image scanning is slower than the movement of the fan blades. We don’t notice this at slower shutter speeds because the slower shutter speed registers only a blurred image of the fan.

This type of error occurs on all DSLR still cameras shooting video. Even the most expensive models costing thousands of dollars.

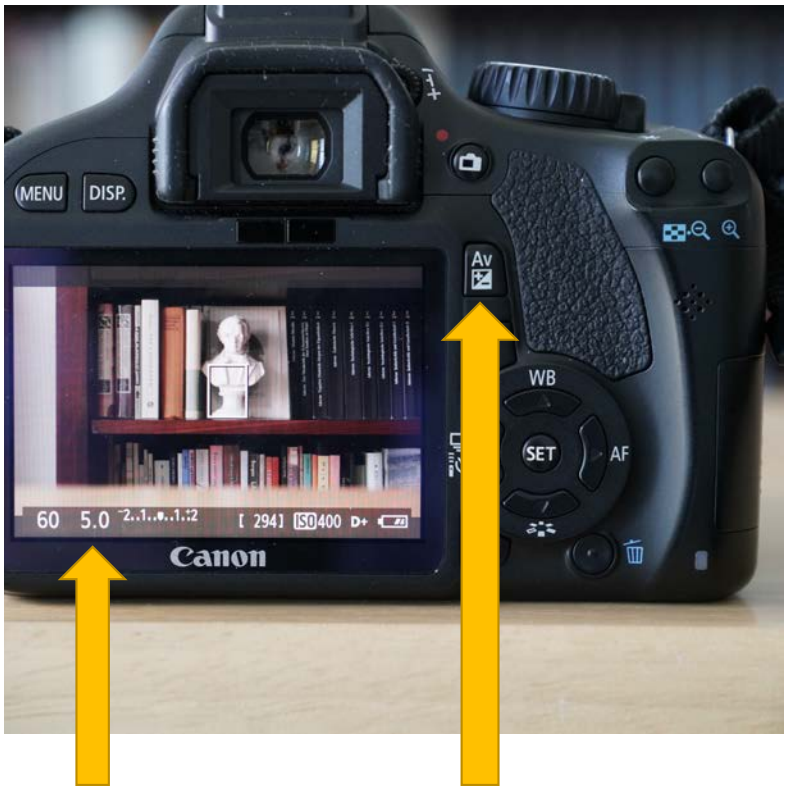
The fan is on high speed. The camera is using the standard shutter speed for 1080 24p video: The fan blades appear as we would see it with our eye: blurred!



The fan is on high speed. The camera shutter speed is very high for 1080 24p video. The fan blades appear distorted. Normally all three are the same shape and size.



Aperture

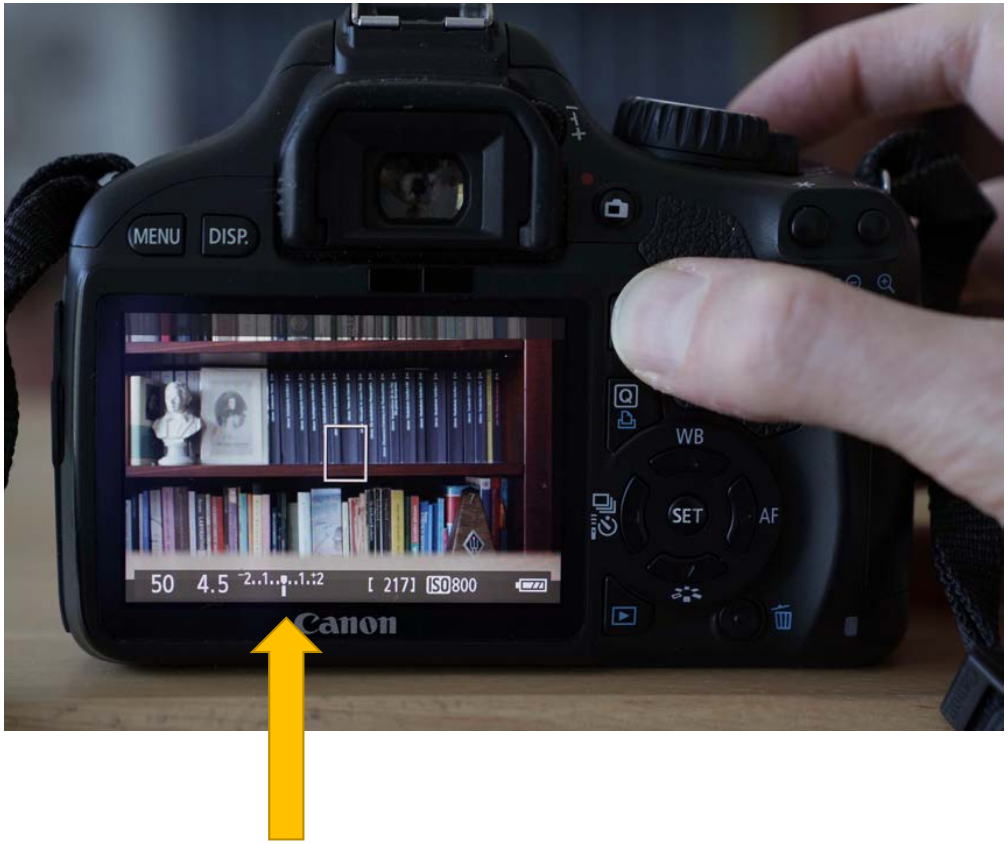


To adjust the lens aperture opening hold down the A/V button on the back of the camera and turn the dial on top.

The aperture opening (or f stop) is indicated to the right of the shutter speed.

With this zoom lens, the largest available f stop varies with the focal length of the lens.

Correct Adjustment



When the dial lines up on the middle, the optimal exposure has been reached.

About Aperture

There is a metal leafed opening in the lens that lets in more or less light to the sensor (or to the film in an old film camera). This is the aperture. The smaller the number, the larger the opening.

F 2 is a large opening.
F 16 is a smaller opening.

Aperture and Focus

- Aperture also affects how much of the image is in focus, this is called depth of field.
- The larger the lens opening (the smaller number the aperture) the narrower the depth of field or the less that is in focus.
- Focal length also affects depth of field. Wide angle lenses show a greater area in focus. Telephoto lenses will create a narrower depth of field.
- To achieve a very narrow depth of field with the lens supplied with this camera, you should have an aperture opening of f 5.6 and a focal length of 55mm.

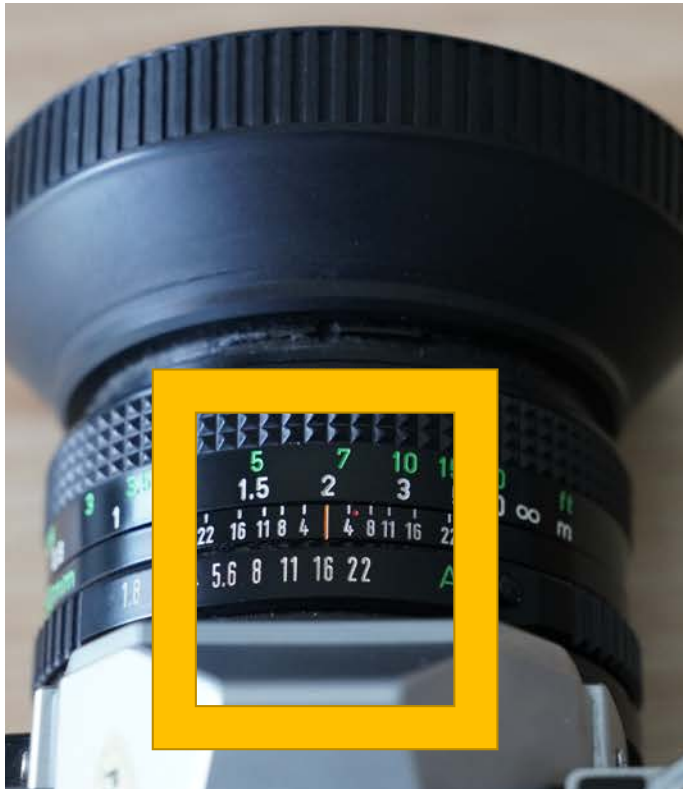
Depth of Field

Fixed focal length lenses used to have depth of field markings on them for each aperture. Here is a lens on an older Canon film camera.

Here the markings are indicating that at f 4, the depth of field will be between just before and after 2 meters or between 6 and 8 ft.

Depth of field refers to the area that is in focus.

Depth of Field



Here the markings are indicating that at f 16 the depth of field will be between 1.4 m and 3.2 m (approximately) or between 4.6 ft and 11 ft.

Depth of field examples

- The following still images show varying depths of field.
- The images start with a small aperture opening and then as the aperture opening increases the depth of field becomes shallower.
- Keep in mind that these are still photos that is why the shutter speed is varying, but the principle is the same in a video image. Ignore the shutter speed information I supply here. Just observe the aperture change.
- The focal length of 30 mm remains the same.

F 29: coffee cup text to buildings in focus. My point of focus is the sheet music.

f 18: coffee cup text is blurred

F 11: foreground and background blurred

F 8: Pencil is blurred

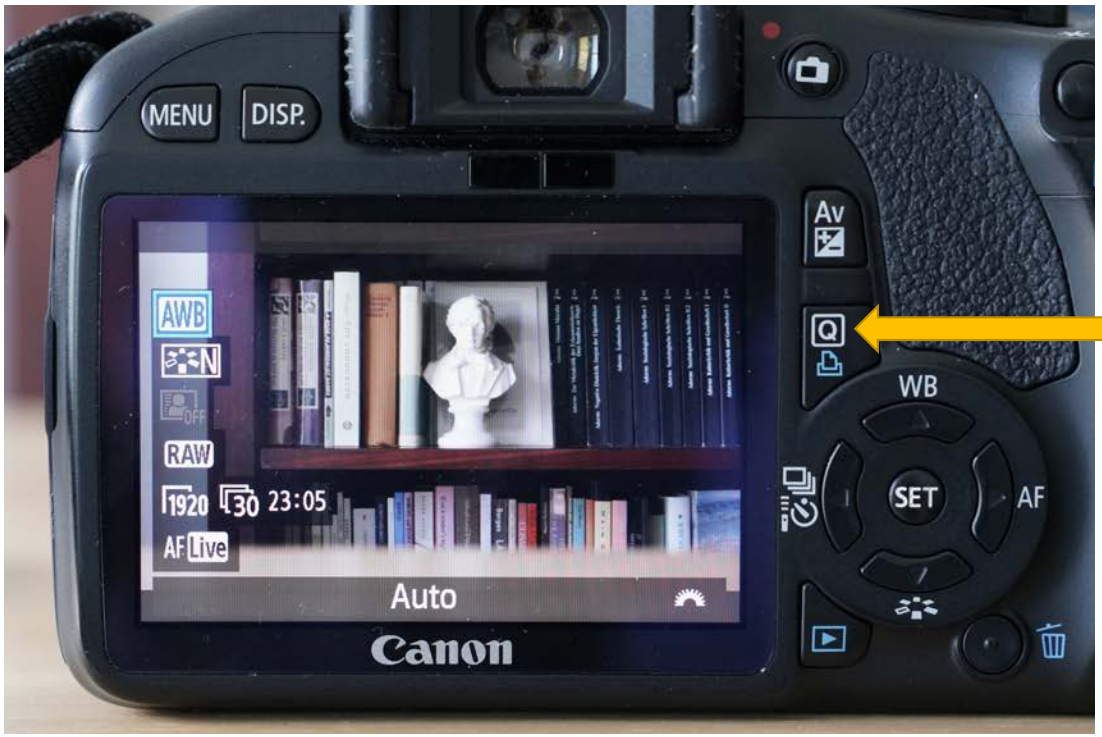
F 5.6: book spine is somewhat blurred

F 4.5: the sheet music is now the only object in focus, and not all of it is in focus.

White Balance

- Light has a color temperature that varies depending on the time of day and the type of light
- Our eyes adjust naturally but a camera must be told how to adjust
- It is important to have an accurate white balance **before** you begin recording. Adjusting video color can be difficult to correct with software. Judge white balance by looking at white objects (obviously) but also by looking at skin tones.
- Usually the Auto White Balance feature is correct.
- In the following examples I am adjusting white balance through the Quick Menu.

Auto White Balance



Quick Menu Button

The Quick Menu gives you access to many image settings.

Tungsten White Balance in a Daylight Situation

There are also white balance presets to choose for different lighting scenarios.

Here the preset is obviously incorrect for this situation.

Custom White Balance

You may run into difficulties in a “mixed” lighting scenario, for example where there is a mixture of daylight and fluorescent or tungsten light. If none of the presets work, then perform a manual “custom” white balance.

Take a photo of a white piece of paper in the same lighting as your subject.

Then go to Menu/ Custom White Balance.

Custom White Balance

This menu setting automatically selects the last still image you have taken as the custom white balance reference.

Quick Menu Custom White Balance

This becomes the custom setting for white balance.

Other Exposure Settings: Highlight Priority

The Canon Rebel cameras record video using a video codec that has a very low dynamic range (about 3 stops). The image has a high contrast and is easily overexposed.

Enabling highlight tone priority can help to prevent overexposure.

This will increase your lowest possible ISO to 200 but it will help with preserving highlight (brightness) information.

Judging Exposure with Playback

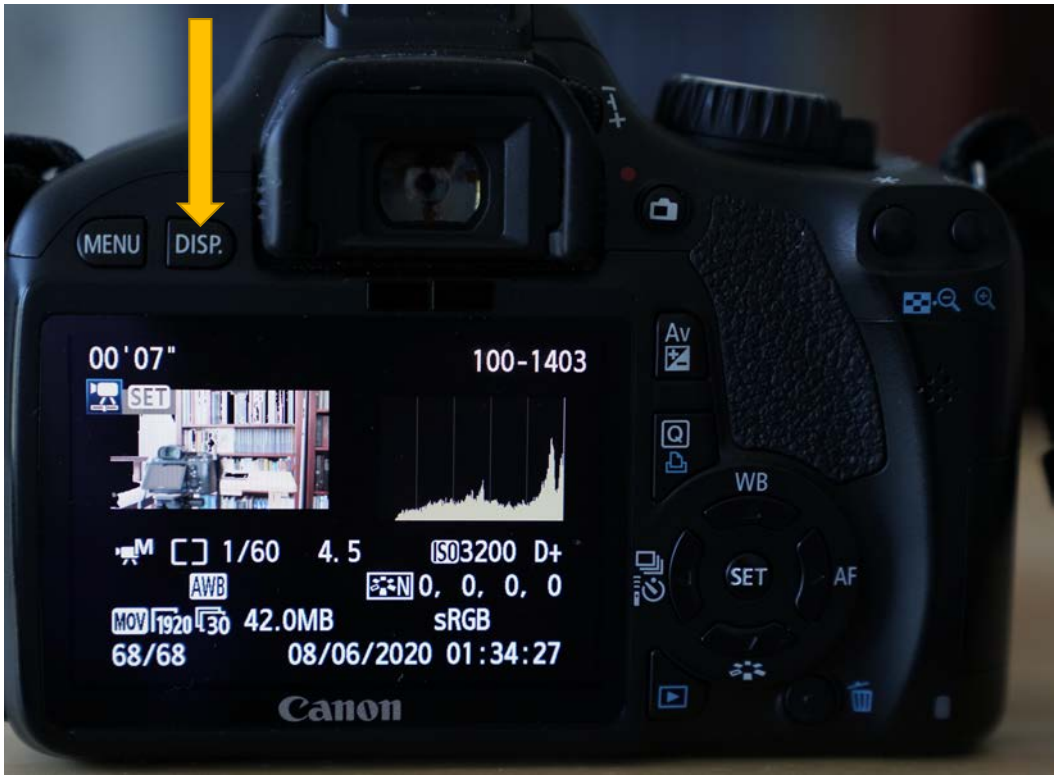
- It is difficult to accurately judge exposure with the LCD screen. In particular, you want to try to avoid overexposing your image.
- Overexposed areas in video can be so bright that they are “blown out” masses of white with no image information.
- This camera does not have Zebra stripes for judging overexposure nor does it have a histogram in the LCD monitor while you are shooting.
- However, these things (or something similar to them) do appear in the playback display.

Judging Exposure with Playback

Make a quick movie recording to judge your exposure: just a few seconds.

Then go to the Playback Menu by selecting the play button on the back of the camera.

Checking Exposure in Playback

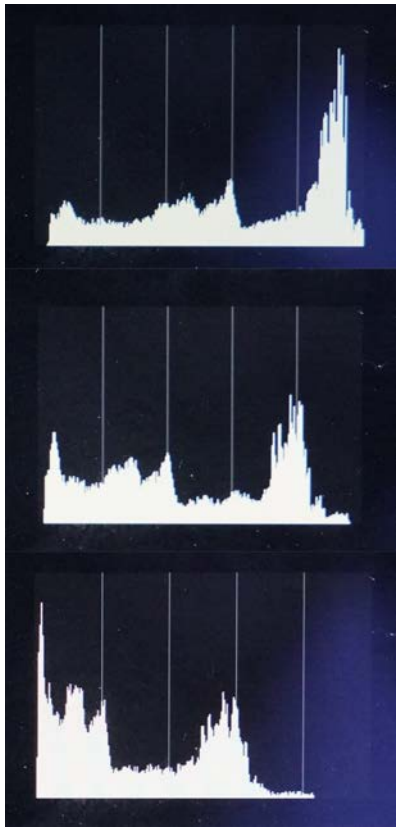


Press the display button to see an alternate display.

If the image is overexposed, the image on the left will have areas that are black.

On the right, you have the histogram. You can see that the image has too much highlight information.

The Histogram



The histogram is used for judging the overall contrast of the image. Values increase in luminosity from left to right: shadows on the left, highlights on the right.

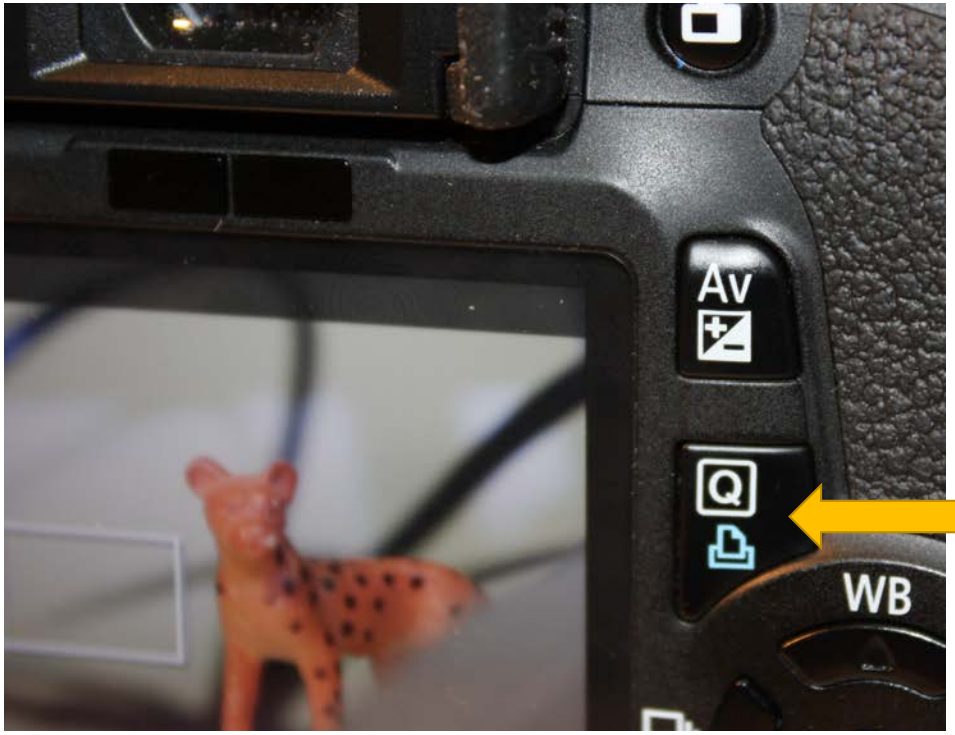
Here are three different exposures of the same subject:

The top histogram indicates a very bright image, possibly overexposed.

The middle histogram indicates a high contrast image, meaning that it has values more evenly distributed throughout the range of luminance. This is a correct exposure.

The bottom histogram indicates an image that is too dark, possibly underexposed.

Quick Menu

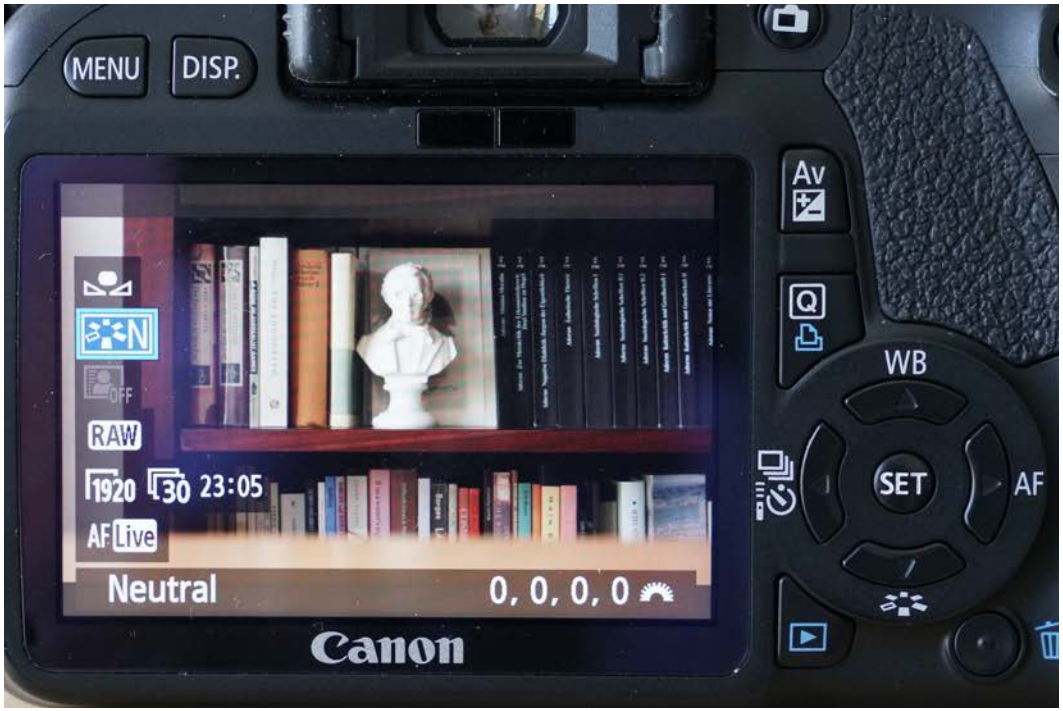


The Quick Menu displays common settings in the LCD display:

White balance
Picture Style
Still Image quality
Movie Recording Size
Auto Focus options

Change the parameters for each setting with the dial on top of the camera.

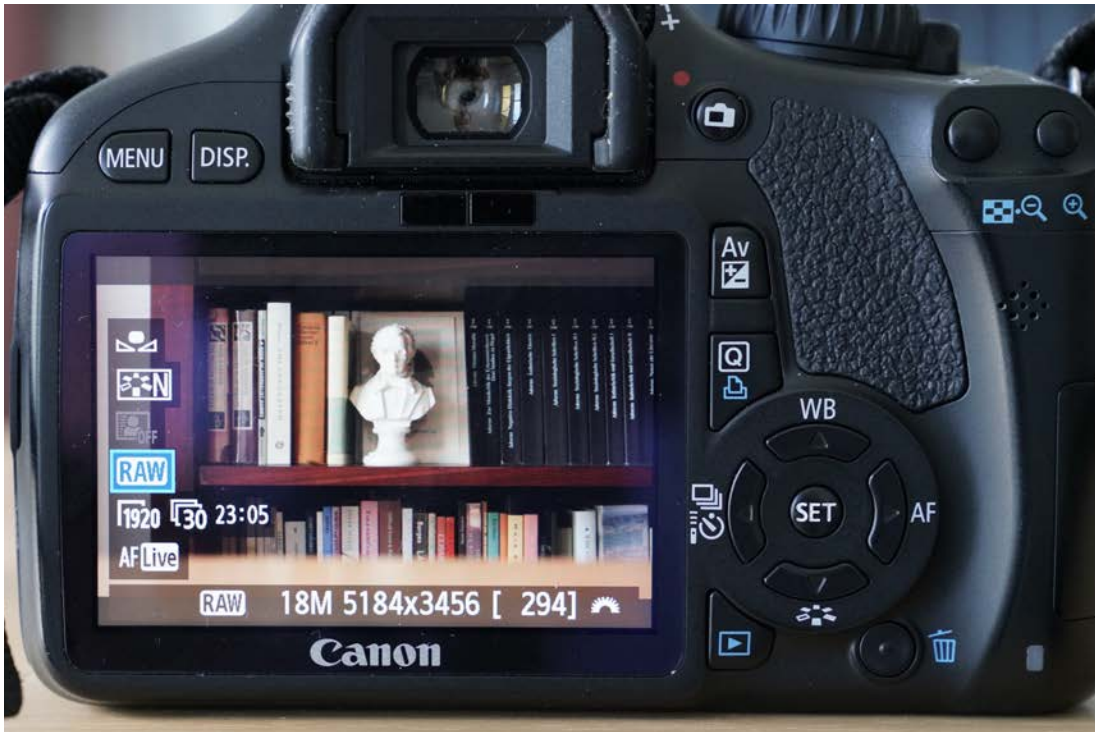
Picture Style



Picture Styles influence the colors and contrast of the image.

For video use the Neutral Picture Style. The video image quality is already so limited, it is best not to increase contrast or saturation with a Picture Style preset.

Still Image Quality

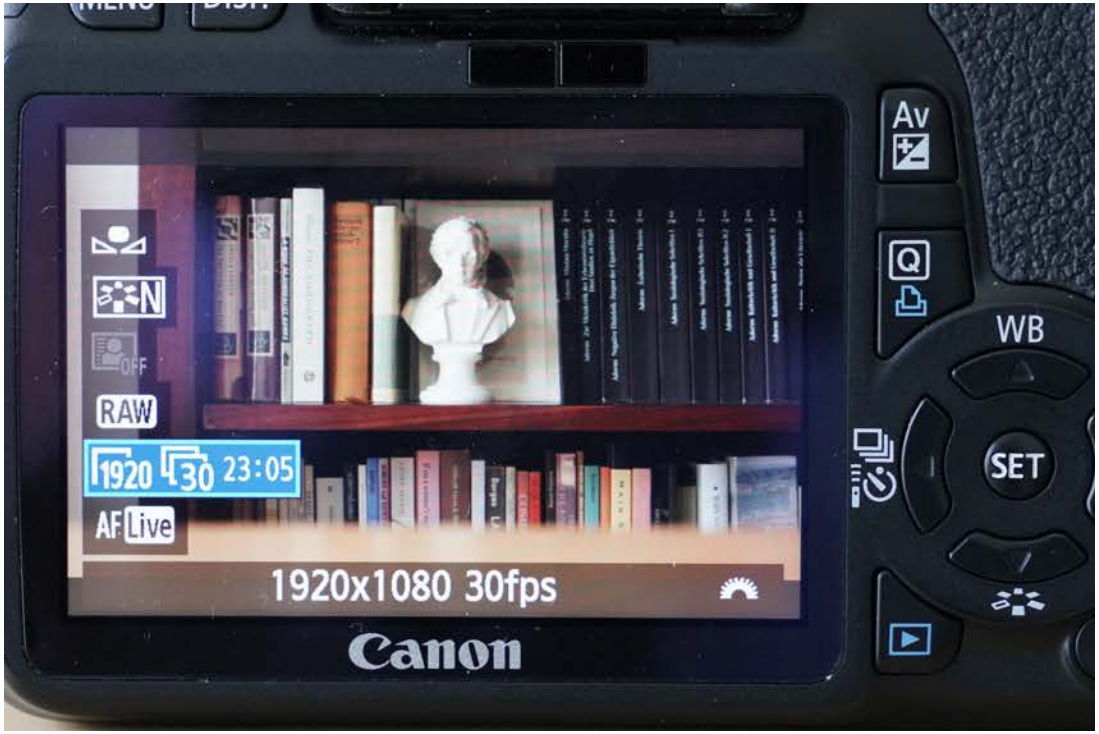


Adjust the still image quality as you like for taking still images but be sure to take photos separately from recording video

The camera manual says that you can take still images while shooting video, but in practice this stops video recording.

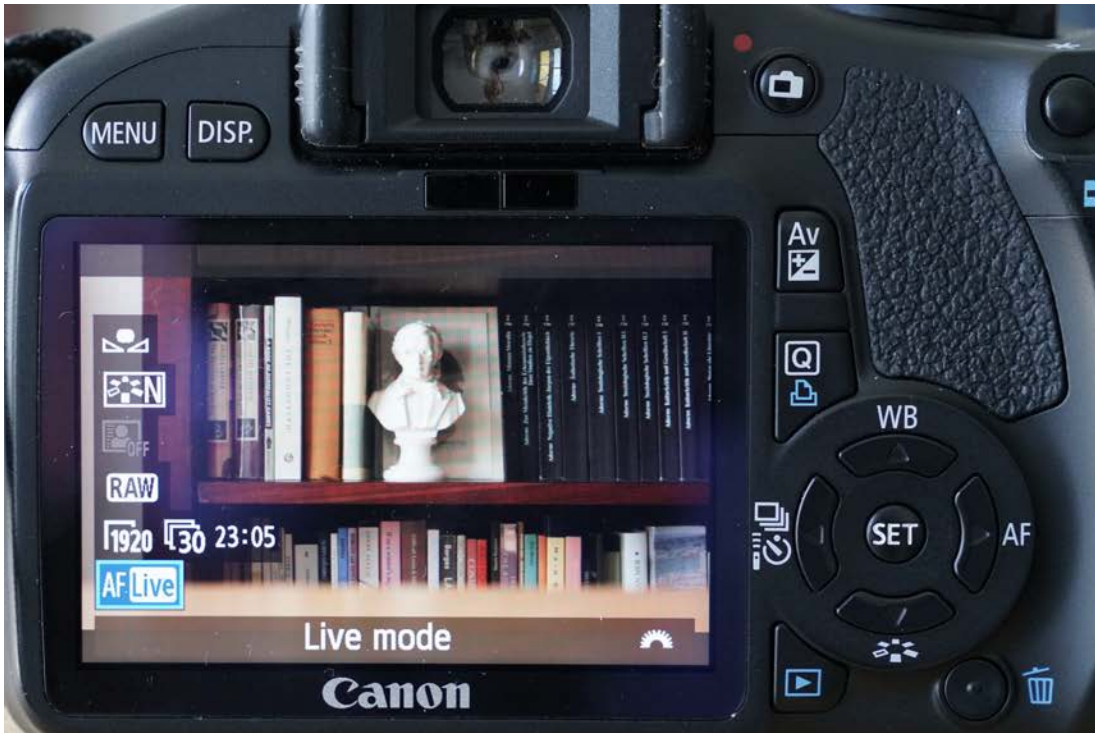
If you require still images and video of a subject, consider taking photos separately. Still images extracted from video are a much lower quality than medium sized (and higher) photos.

Movie Recording Quick Menu Setting



The Movie Recording Quick Menu Setting also displays the amount of recording time left on the SD card.

Auto Focus Mode



Live Mode is the recommended auto focus mode.

The switch on the lens must be set to AF.

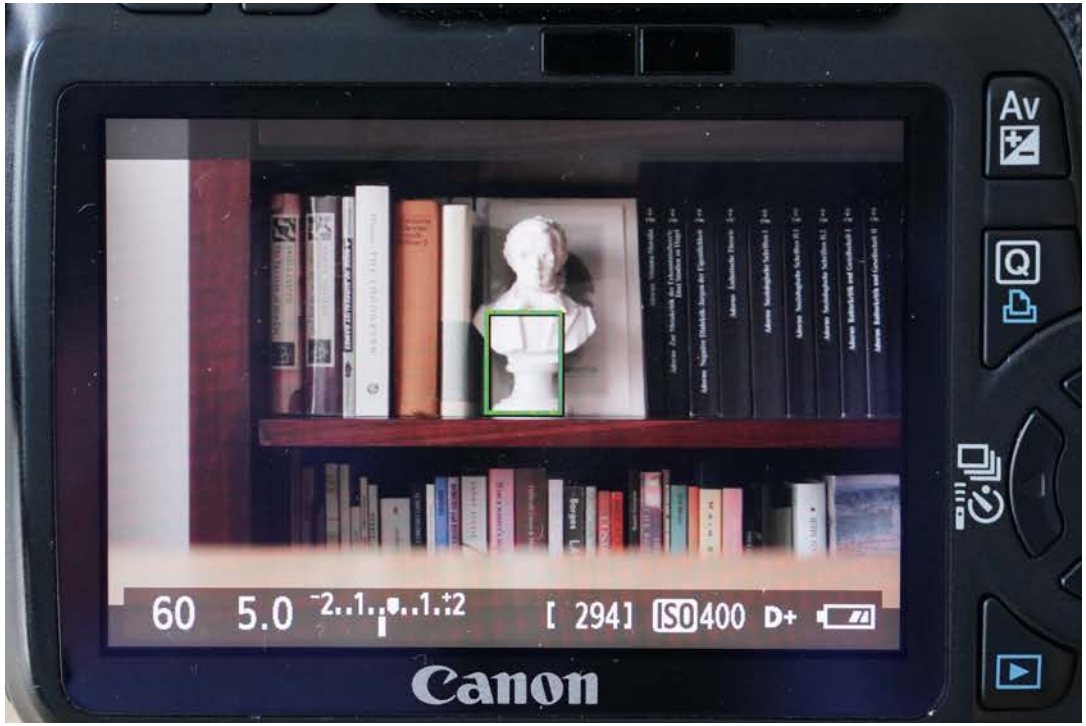
Focusing and Movie Recording

- There is no continuous auto focus when recording video.
- Use manual or auto focus to focus before starting your video recording.
- If you wish to change focus while recording use either method.
- Make sure that the “AF during Movie” menu setting is enabled if you want to use auto focus while recording.
- Keep in mind that the auto focus method can be slow and distracting. Manual focusing may be preferable while you are recording.

Auto Focus

- To use Auto Focus:
- Set switch to AF on the lens.
- Set Shutter/AE lock Menu setting to the AF/AE lock position
- Set AF Mode Quick Menu Setting to Live Mode
- Point the camera at the subject.
- Press the shutter button down halfway.
- The auto focus area should appear green when the object is in focus.

Auto Focus



The focus area is the rectangle in the middle of the image.

Pressing the shutter button down halfway, the rectangle will turn green when the focus is reached.

The focus area can be moved around the image with the four pointed wheel on the back of the camera.

Manual Focus

- To use Manual focus:
- Set Focus to MANUAL in the Menu Setting or set the switch to MF on the lens.
- Point the camera at the subject.
- Use the magnifier button to digitally zoom.
- Move the outer ring on the lens to focus.

Use the magnifier for Manual Focus

Focal Plane Indicator

When focusing manually, you are calculating the distance from the subject to the camera's sensor, not the front of the lens.

Most cameras have a focal plane indicator: a circle with a line through it. You are focusing up to this point.

Essential Menu Settings

Set Shutter/AE lock Menu setting to the AF/AE lock position.

The function of these two buttons on the camera change depending on whether you are in manual or auto focus.

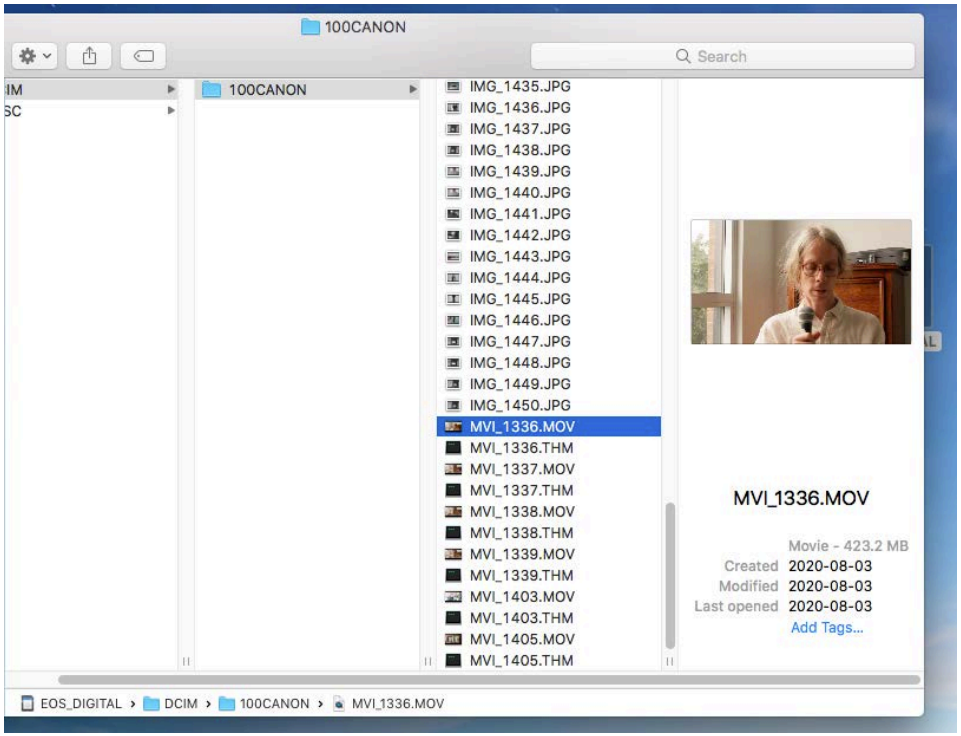
Focusing and Zooming

- The camera comes with a 18-55 mm zoom lens. This is a wide-angle to medium telephoto lens. If you change the focal length of the lens then the focus may change.
- Even if the camera is stationary and remains fixed on the same subject, as soon as you zoom then you may have to refocus.
- Your aperture selection and focal length will also determine how much of the image changes focus.

Conclusions about focusing

- Because of the limitations of auto focus and the limitations of the zoom lens supplied with the camera we can conclude the following:
- Try to avoid shots with camera movement
- Try to avoid zooming while recording

Copying Video Clips to Your Computer



The camera records video using a H.264 codec (45- 50 mbps) in the .mov container. These files will open up in QuickTime Player, VLC media player or any video editing program, including iMovie.

Simply copy the clips from the SD card on to your computer and import them into the editing software of your choice.
There is no need to convert these files.

The .THM (thumbnail image) files can be discarded.

Canon Rebel T2i (EOS 550 D)

Audio Recording Options

The following is a realistic assessment of the difficulties of recording audio with this camera. A real video camera with proper XLR microphone inputs will simplify your task.

Recording Audio: Three Options

1. The camera has a built-in low-quality microphone on the front of the camera. This is useful only to record audio as a reference. Ignore this option.
2. Mounting a small directional microphone on the top shoe of the camera and input directly into the camera. Unfortunately, the Canon T2i has an automatic volume level adjustment that adds noise to the audio signal. This is a somewhat acceptable option.
3. Recording audio with an external (for example, a Zoom) recorder and a variety of microphones. This is the **best option** but the audio will have to be synchronized to the video in editing software.

Option Two: Small directional microphone

The Rode microphone is small mono directional microphone that can be mounted directly on the camera.

It picks up sound from any source that is directly in front of it and minimizes sounds from the rear and sides of the microphone (a super-cardioid polar pattern). Point the microphone at the mouth of the speaker.

Because the camera is mounted directly on the camera it can pick up any noises from operating the camera.

Option Two: about the ”wind shield”

The microphone can be used with or without the foam windshield.

In general, it is recommended to keep the windshield on.

This “windshield” does not offer any protection from the wind. Never use this microphone outside on a windy day. The CDA has a microphone kit that can be used in wind.

The “windshield” muffles the sound a little bit. It makes the input levels a bit lower and the high frequencies slightly less prominent.

Audio Output Level Adjustment (Pad) and Battery

The microphone requires a 9 volt battery (not included).

In this compartment, with a magnifying glass and a pin, the output level for the microphone can be adjusted.

Arrange the two switches to correspond to the desired output level.

The camera has no input level meter, so how do you know which microphone output level is correct? Read on.

Audio Output Levels for Rode Microphone

- The Canon DSLR camera has an automatic level adjustment that adds a constant hiss to any audio signal using the microphone input.
- An “acceptable” recording depends on the signal to noise ratio. Record speech at the -10 dB output level and 0 dB input level. Only use the -20 dB level for loud subjects.
- If the speaker under four feet (1.2 m) from the camera use the -10 dB level. If the speaker is between 4 and 7 feet (2.1 m) from the camera use the 0 dB level. Don’t use this microphone if the person is much beyond that distance from the camera.
- These output level settings pertain to using this microphone with this model of camera. Later Canon Rebel models may have improved the automatic level adjustment. The Sony DSLRs in the CDA depot have better manual control microphone inputs although they are still quite noisy.

Microphone Input

The microphone input is on the side of the camera.

There is no headphone output.
So there is no way to monitor audio input directly into the camera!

There is no way to check your audio signal while recording.

The microphone is mono, so the same signal will be recorded on the left and right stereo channels of the video clip.

Audio Menu Settings

There are only two audio controls on the camera:

Disable the beep in the menu.

Turn audio recording on.

Rode Microphone ON

Because there are no audio meters on the LCD screen of the camera, and no indication that you are recording audio, it is very easy to plug in the microphone and to not turn it on.

Problems with Background Noise

Point the microphone away from any noise in the environment. Fans, refrigerators, traffic and other types of constant “broadband” noise can be amplified by the microphone. Keep the microphone as close as possible to the subject using the recommended output settings.

Try not to manipulate the camera while you are recording.

If you have difficulty eliminating background noise in your environment it is best to use a different microphone. Use an external recorder and a dynamic microphone or a wireless clip-on microphone.

Option 3: Recording to an External Recorder

This is the Zoom H6N recorder. The CDA has different models of Zoom recorders with either two, four or six microphone inputs. They all operate with AA batteries.

The recorder has a tripod mount on the bottom of it. It can also be mounted to a microphone stand with an adapter.

The H6N has six inputs: two inputs are for the built-in stereo microphone and the remaining four are XLR/TRS inputs for other microphones.

Zoom Recorder Controls

On the left side of the Recorder:

The power button.

SD card slot: the Zoom records directly on to a SD card.

Headphone output: Always monitor the signal with headphones. You may hear an echo in the headphones while recording due to latency.

Check the first recording by playing it back to make sure that this echo is not present.

Zoom Recorder Controls

On the right side:

USB output to use the recorder as a USB interface or to copy files on to a computer. You can also copy files by taking out the SD card.

The menu button and the toggle switch to go through the menu pages.

Recommended Headphones

Use enclosed analog headphones to monitor recording, like the pair pictured here.

The CDA has many Sennheiser HD 280 headphones. These are excellent.

The Sennheiser HD 206 headphones are OK too if you want to purchase something cheaper of your own.

Microphone Options for the Zoom Recorder

- The built-in stereo XY microphone
- Directional condenser (Sennheiser 416)
- Dynamic (Shure SM48)
- Wireless clip-on or Handheld microphone

The CDA has other microphone options as well, but these are the most common for voice and audio for video recording.

The Built-in XY Microphone

- The built-in XY microphone is good for subjects at a close or medium distance. It does pick up other sounds in the environment. A stereo microphone provides a recording of a sound with a feeling of depth (an idea of how that sound is situated).
- The center of the two microphones should be directly facing the subject or sound source. Point the Zoom recorder at the subject, like you would with a directional microphone. It will pick up sound in a heart shaped area in front of the microphones.
- The Zoom recorder is often used by musicians to get down ideas quickly with a minimum of fuss. The built-in microphone is not ideal but it can be used quickly with a good result.

Recording with the Built-in Microphone

The built-in microphone is on top of the recorder.
It records in stereo with two directional microphones in a XY pattern.
You can adjust the width of the stereo recording from 90 to 120 degrees.

120 degrees will pick up audio from a wider area. The recording will feel more spacious. For a recording of a single person in front of a camera, choose the 90 degree width.

The recording level is adjusted below the XY microphone.

Enable the L and R buttons on the recorder. Press the R button while still pressing the L button. On the screen, the XY channel will turn red, indicating that it is ready to record. Now you can monitor your signal to see if it is loud enough.

Recording Levels

Adjust the recording volume level so that the audio peaks around -12 dB or between -12 and -6 dB.

Press the Record button to start recording.

The recorder will indicate the recording time in red.

About Digital Volume Peak Meters

- Digital Volume Peak Meters end at 0 dB.
- The recording signal should never go anywhere near 0 dB.
- If a sound gets to 0 dB, it will clip and distort.
- The read out on a digital peak meter cannot respond rapidly to display transient (very rapid) peaks. For this reason, it is necessary to give the recording some “head room”.
- Keep your peak levels well below -6 dB, ideally within the -12 dB and

-6 dB range. Zoom recommends around -12 dB.

Menu Settings: Rec Format

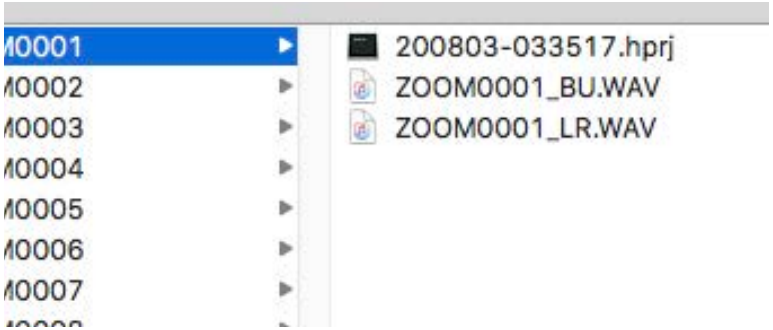
Record in the uncompressed WAV format. Do not use the MP3 format.

The most common recording format for video is WAV 48 kHz/24 bit. Be consistent. Always record at the same sample rate for one project.

48 kHz refers to the sample rate. The sound is being sampled 48000 times per second. The higher the sample rate, the more accurately high frequencies will be reproduced.

24 bit refers to the detail of each sample. The higher the number, the greater the detail and the larger the file size.

Menu Settings: Backup Rec and File Structure

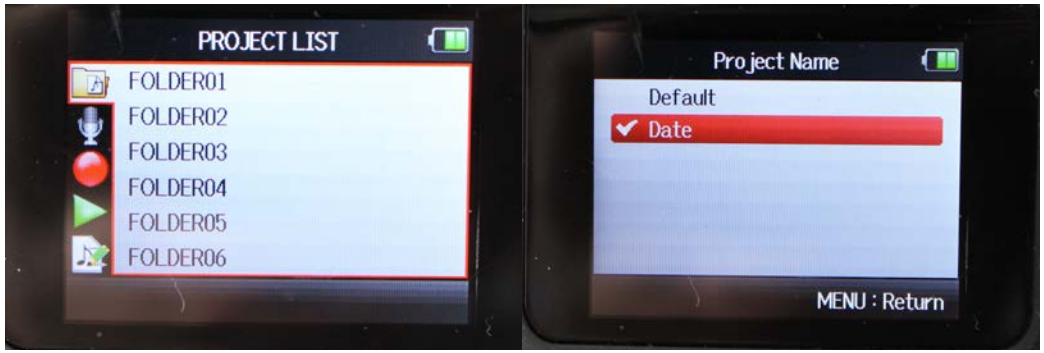


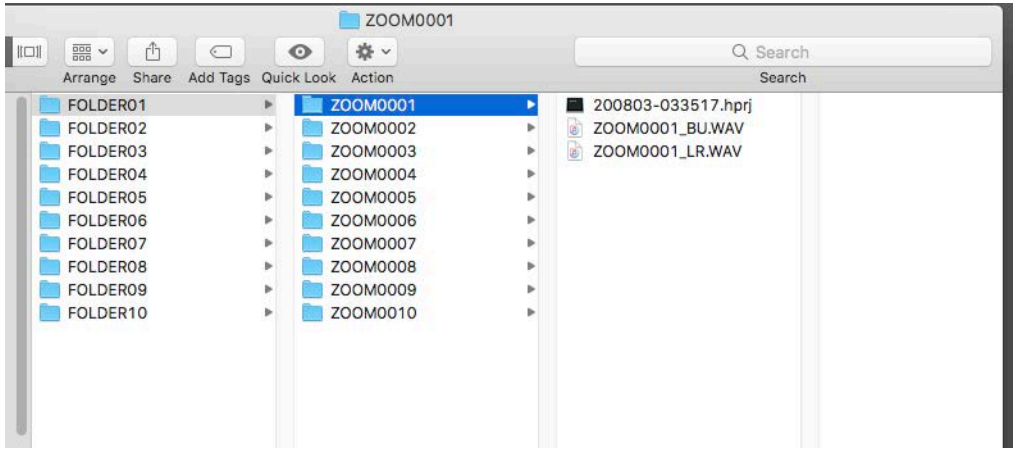
The Backup Rec option will record a duplicate file at a -12 db lower volume than the original file. This is a safety recording in case your original file becomes too loud and distorts.

Distortion cannot be corrected. So I advise turning on this option.

The backup file appears in the same audio folder as the original file marked as “BU”.

Menu Settings: Project Record Location



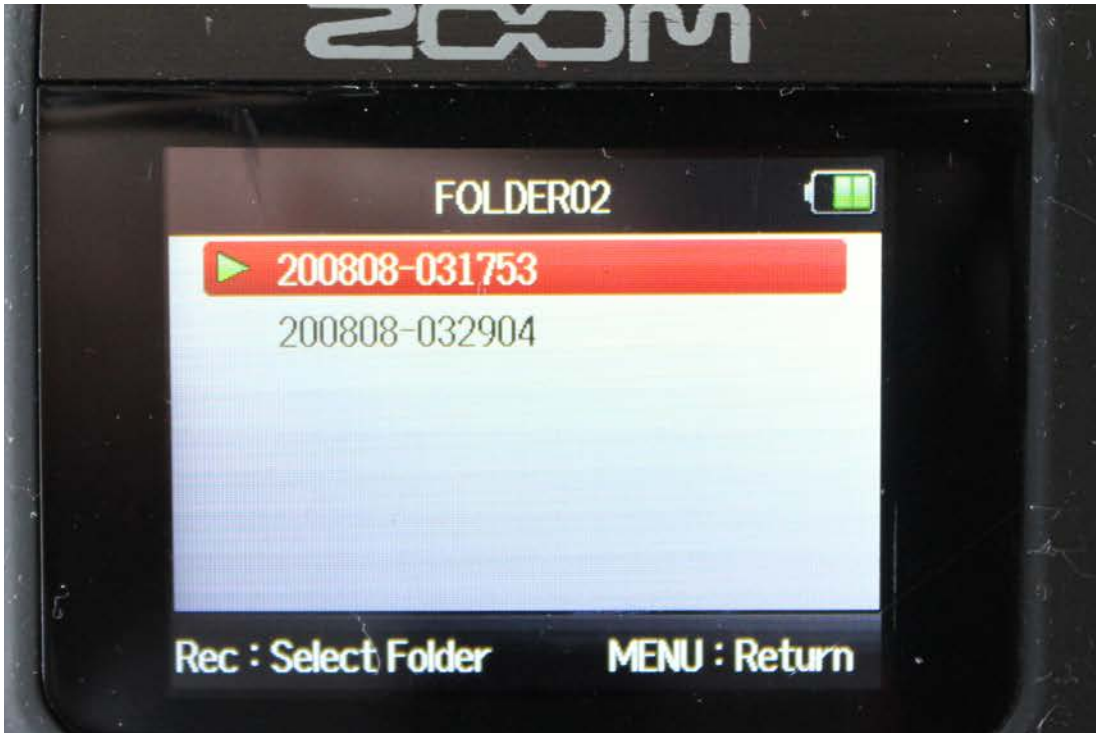


There a ten folders on the SD card.
Make sure you know into which folder you are recording!
Each audio file will have it's own folder within that folder! The file name of the audio will indicate the channel. "LR" means the built-in microphone.

The file appears in the menu system of the Zoom recorder as the date (shown above as year (20), month (08), and day (03). But the actual audio WAV file has the generic ZOOM name.

The .hprj files are not required for editing and can be discarded after you are finished with the Zoom.

Playback of Files



Do a quick test recording.

In the menu system, navigate to the folder where you have recorded the file. Then press play on the Zoom recorder.

Adjust the volume for the headphones on the side of the recorder.

Information on the LCD Screen

The main screen tells me the following:

I am recording into Folder 01 on the SD card.
My recording format is 48 kHz 24 bit WAV file.
I am recording on track 1 (red) that has phantom power.
I can also see that I have compression effect on the XY (built in mic) input, a lo cut effect on input 2.

Phantom Power and effects will be explained in following slides.

Output to Camera not possible with the T2i

The Zoom recorder has an analog line output to send the audio signal to another device while it is simultaneously recording audio to the SD card.

This output could be used to send audio to the microphone input of a DSLR camera. Unfortunately, this output does not work with an input that has an automatic level control like the microphone input of the Canon T2i.

You cannot use it with the Canon T2i camera, but you can use it with other DSLRs like the Sony A7S II or the Sony A7R cameras.

Using Other Microphones

- The built-in microphone on the Zoom makes a good clean voice recording, especially when placed very close to the speaker (1 to 2 feet, .3 to .6 m).
- However, the audio file can be quite thin sounding in comparison with other microphones. The low frequencies are not very present and there is also a sense of space from the stereo XY pair. This is not an “intimate” recording where you have the sense of someone speaking directly to you.
- If this is what you desire, the Shure SM 58 and Sennheiser AVX clip-on microphone can provide that type of recording.

Dynamic vs Condenser Microphones

- A Microphone is a transducer changing acoustic energy to electrical energy.
- Dynamic microphones do not require electrical power to operate. They can be used to record very loud sounds.
- Condenser microphones are smaller and more sensitive. They are ideal for recording soft sounds. They can reproduce a greater range of frequencies but they must be powered by an electrical current called “phantom power”.
- When using condenser microphones you must be more careful to avoid distortion from loud sounds or from too much microphone pre-amplifier gain.

Directionality: Pick-up (or Polar) Patterns

CHARACTERISTIC	OMNI-DIRECTIONAL	CARDIOID	SUPER-CARDIOID	HYPER-CARDIOID	BI-DIRECTIONAL
POLAR RESPONSE PATTERN					
COVERAGE ANGLE	360°	131°	115°	105°	90°
ANGLE OF MAXIMUM REJECTION (null angle)	—	180°	126°	110°	90°
REAR REJECTION (relative to front)	0	25 dB	12 dB	6 dB	0
AMBIENT SOUND SENSITIVITY (relative to omni)	100%	33%	27%	25%	33%
DISTANCE FACTOR (relative to omni)	1	1.7	1.9	2	1.7

Microphones do not only pick up sound from what they are pointing at. They can have a spherical (omni-directional) or more directional (hyper-cardiod) pick-up pattern.

Each one of these patterns cancels out sound from behind the microphone. Look at the angle of rejection (of sound) on the chart and the amount of rear rejection.

This chart and image on the following slide are reproduced from p. 27 of the *Shure Microphone Techniques Recording Manual*, Shure Education Publications, 2014. This publication can be downloaded free from the Shure website.
I highly recommend it!

Microphones Inputs

All the following microphones will plug into one of the four XLR inputs on the Zoom.
The Zoom accepts ¼” TRS cables and XLR male connectors.
The XLR male connection has three plugs.

Input Controls

Adjust the volume for each microphone input on the front of the Zoom recorder.

XLR microphone inputs should have the PAD set to 0.

The PAD switch is used when connecting devices that output at a higher volume: mixers or effects pedals.

Do not plug electric guitars directly into the Zoom.

Shure SM 58 Dynamic Microphone

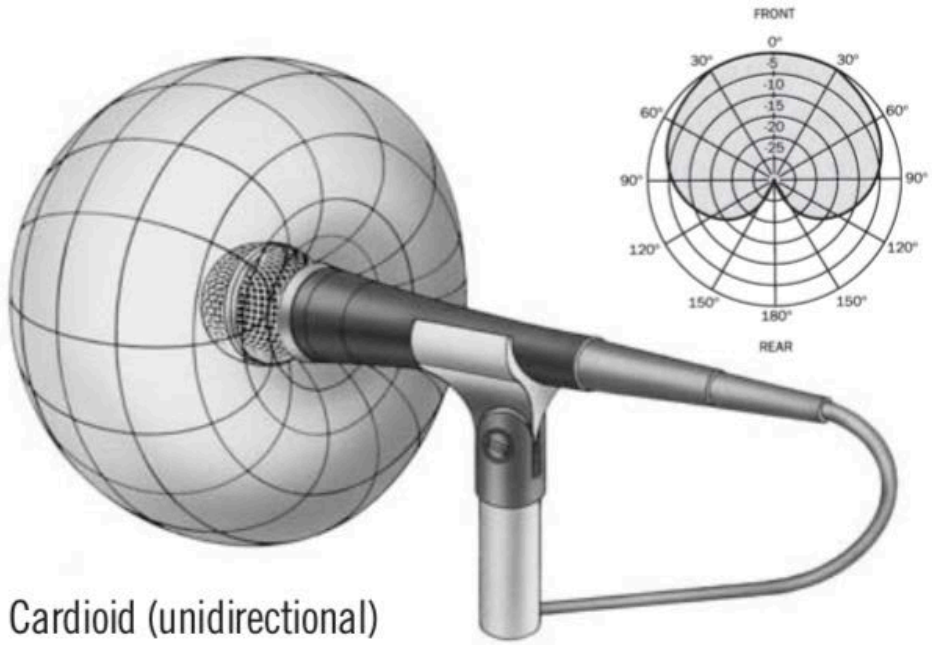
The Shure SM58 is a dynamic microphone. It does not require power to operate.

The dynamic microphone has a low volume output so it will require more input gain than a condenser microphone.

The SM58 has a cardiod polar pattern and is a great choice for voice recording in an environment where you cannot eliminate background noise. It will only pick up sounds very close to it.

The heart shaped cardioid pick-up pattern requires you to place the microphone close to your mouth.

Pick-up or Polar Pattern of a Shure SM58



Cardioid (unidirectional)

The Shure SM 58 dynamic microphone will offer the maximum rejection of surrounding noise.

It is often used by vocalists on a stage where is can minimize the sound of all the surrounding musicians.

Dynamic Microphone Placement for Voice

In this photo I am holding the microphone about six inches from my mouth but not pointing the microphone directly at my mouth to minimize “popping” sounds created by consonants “b”, “p”, “t” and “d”. People who speak softly may benefit from pointing the microphone more directly at themselves but still trying to keep a little “off axis” by pointing it between the nose and the mouth.

Dynamic microphones can accentuate the bass frequencies especially when placed very close to the mouth. There are ways to avoid this “proximity effect” (see next slide). I recommend a 80 Hz lo cut.

Lo Cut Filter for eliminating Proximity Effect

A low frequency cut filter can be added on an input channel in the Zoom recorder. Go into the INPUT/OUTPUT menu to add this effect. This will reduce the “proximity effect”.

Here I am adding a 80 Hz low cut filter, meaning that the low frequencies will start to have their volume reduced starting at 80 Hz.

The microphone is plugged into input 2. The lo cut filter is indicated by a blue line.

Clip-on Wireless Microphone

For a more inobtrusive microphone (or if you require both hands), use the Sennheiser AVX wireless microphone kit.

The clip-on wireless microphone should be placed about 20 to 25 cm below your mouth. It also gives a very close “intimate” recording like the SM 58.

This is an omnidirectional condenser microphone so it does pick up more room noise than the SM 58. The pick-up pattern is spherical.

Condenser microphones are more sensitive. The speaker should avoid wearing noisy clothing like squeaky leather jackets or bead necklaces, etc.

Establishing Wireless Transmission

The Sennheiser AVX wireless clip-on microphone must be plugged into a transmitter.

Turn on the transmitter first and then turn on the receiver once it is plugged into the WAVE recorder and has phantom power (see next slide).

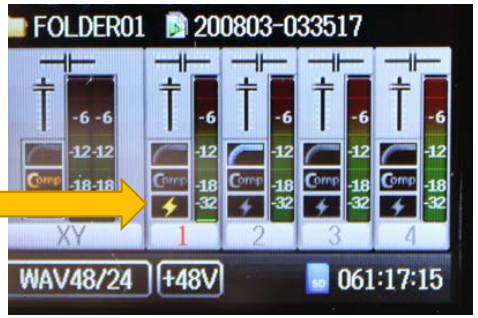
Then long press the PAIR button on the transmitter until it flashes green. Then long press the PAIR button on the receiver until it flashes green. A link will be established shortly and both lights will be green.

Phantom Power must be enabled

All audio devices that accept an input will have a “+48 V” button. This can be turned on to deliver “phantom power” to a condenser microphone. It should never be turned on when a dynamic microphone, like the SM58, is plugged into the channel.

To use the AVX wireless condenser microphone through the receiver, go into the Menu system to enable the Phantom Power for the input channel. Here I am recording on channel one.

Phantom Power is indicated by the +48V note underneath the channel and the lightning bolt symbol.



Output Volume Level adjust on Receiver

A meter on the side of the receiver shows the output volume level of the signal to the recorder.

Press the AF Out button to change the level.

Keep the level three quarters of the way up (three lights lit up).

The input should peak on the Zoom recorder around -12 dB.

Sennheiser 835 handheld microphone

This is like a wireless SM58 microphone, but it has an omnidirectional polar pattern. It will pick up a little more room noise than the SM58.
Position the microphone in the same manner as the SM 58 microphone.

This microphone has a built in transmitter.
Follow the same procedure: turn on the microphone first and then turn on the receiver once it is plugged into the WAVE recorder and has phantom power.

Then long press the PAIR button on the microphone until it flashes green. Then long press the PAIR button on the receiver until it flashes green. A link will be established shortly and both lights will be green.

Make sure to unmute the microphone.

Why not plug the receiver into the Camera?

The XVX kit comes with a XLR to 1/8” adapter to plug the receiver straight into the input of a camera.

Do not use this with the Canon T2i or any other DSLR camera that has automatic volume control on the input. The recording will be constantly distorted.

In this picture, the adapter is used with the Sony A7R camera. Both the Sony A7R and A7S cameras from the CDA depot have manual volume control and can be used with the adapter. See the A7R guide for details.

Sennheiser MKH 416 Super-Cardioid

This microphone is a good choice for when you cannot place a microphone close to your subject and it is the best choice for recording outside.

It is a highly directional microphone and should be pointed directly at the subject. It can be placed a long distance from the speaker or subject (12 to 15 feet, 3.5 to 4.5 m) but still produce a good recording. Surrounding sounds will be largely cancelled out.

Never handhold the microphone as pictured. It should always be mounted on a stand or if handheld, it should be in a shock mount.

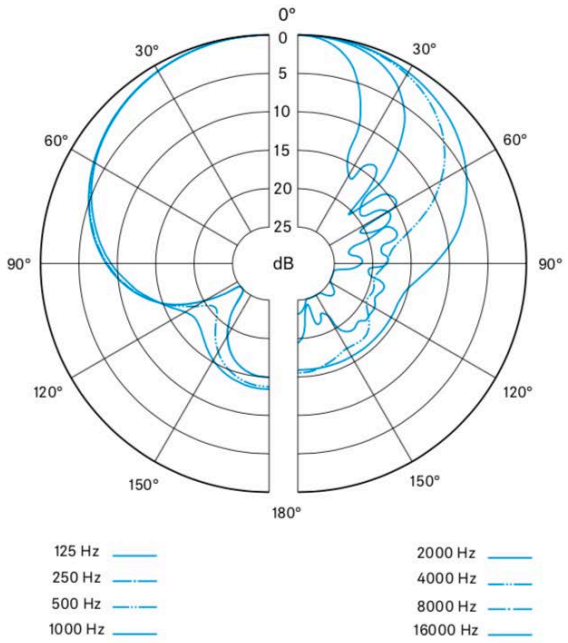
Sennheiser MKH 416 Field Kit

Pictures from the Rycote website.

The MKH 416 has a field recording kit, made by Rycote, for recording outside. The kit includes a shock absorbing mount and windshield. The windshield works well and also comes with an additional furry shield.

The microphone is often mounted on a pole so it can be aimed at speakers from above.

Polar Pattern of the MKH 416



This diagram is reproduced from the Sennheiser MKH 416 manual.

It has an unusual shift to the left in the pick-up pattern.

Adding a Limiter Effect with the 416

The MKH 416 is a very sensitive condenser microphone. I recommend putting a limiter effect on the input channel.

The limiter will avoid loud sounds distorting and peaking. It could also save your ears when you are wearing headphones to monitor the recording.

The Zoom has a number of limiter presets. Find the one that fits your situation.

Slating for Synching

If you are recording audio for video with an external recorder, the audio will have to be synchronized to the image with editing software.

Some software can synchronize the audio to the guide track audio on your video file. For example, if you used the low quality camera microphone on the front of the T2i, this might suffice as a guide track.

But take no chances, always slate each video clip that you record. The CDA has a few proper cinema slates, but here I am improvising by using two pieces of wood. Many people use a hand clap. The next slide has some tips for slating.

Tips for Slating

- The sync mark is a sharp loud noise that lasts for one frame of video.
- A proper slate, two pieces of wood or a hand clap will suffice.
- Make sure the slate is in the frame so that you can clearly see the point of contact. This is your visual reference for slating. A proper slate will also allow you to visually identify the shot and take.
- Start recording on the camera and the audio device before you make the sync mark and announce the shot you are about to record (what is written on the slate). Right before you bring down the slate, say “mark”. This is to distinguish the sound from any other random sharp noise.
- You can slate at the end of a shot if the camera framing is too tight at the beginning. In this case the slate is usually held upside down. You can clap your hands upside down, if you want to.

Thank you for reading this guide.

- I hope you have found this guide helpful.
- Look on the Video and Sound Editing/Technical Support Documents page of the CDA website for more equipment and software guides.
- www.concordia.ca/finearts/cda.html

- Positive and constructive feedback or comments are welcome.

- Write to: philip.hawes@concordia.ca