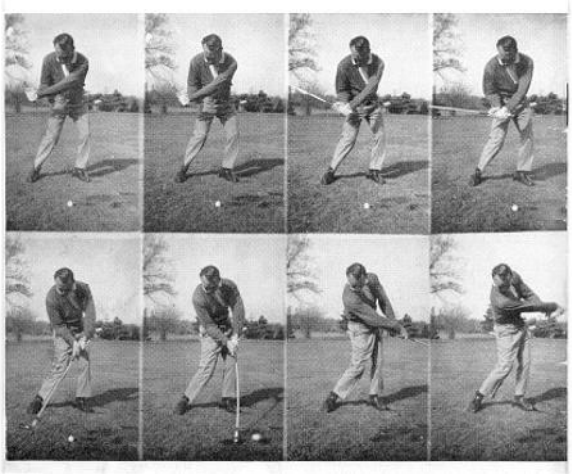
Casio vs. Casio

Casio's flagship model for recording high-speed video, the EX-F1, was introduced in January 2008 and began creating a buzz in the golf industry almost immediately. Part of the reason the camera was not adopted more quickly in the teaching community was its $1,000 price tag. In addition the camera recorded videos in the QuickTime .mov format which almost no golf video analysis programs supported. Later the same year the FH20 was introduced which still offered high-speed video but in the .avi (MJPG) video format and at a lower price point of $400-$450.

This article discusses four Casio Exilim models and gives you some idea of what to expect from them. Some technical detail is purposefully left out but you are welcome to call me if you have specific questions about features or operation of the cameras. In my opinion the Exilims are the best of the next-gen hybrid cameras allowing teaching pros to affordably capture high-speed videos and the EX-F1 is still the cream of the crop.

What do you really need?

Back in late 1970's at the PGA Junior Golf Academy we were using a Polaroid "Graph-Check Sequence Camera" that took an 8-picture black sequence on a small 4" x 5" sheet of photo paper. By wiping a developer pad across the film (I still remember the smell) the picture came to life. The interval between pictures could be set with a dial, the focus was fixed and the shutter speed was preset to 1/1000 of a second. Here's an example of what a swing sequence looked like – usable even today!



When it comes right down to it, if you can't adjust your camera's shutter speed you should be using a different camera. Whether you have 8 pictures 30, 60, 300 or 1,000 pictures per second to analyze shutter speed is key! I have done a lot of testing and a good benchmark shutter speed to use for recording swings outdoors is 1/2,000th of a second. Indoors 1/1,000th would be recommended but even after adjusting the ISO settings on your camera you may have to settle for 1/500th due to lack of light. If your videos are too dark indoors at 1/500th shutter speed you need to buy some lights.*

The Amazing Casio

As a hybrid the Exilims record both photos and videos but look like standard point-and-shoot or SLR cameras. Consider the EX-F1 as an example of just how impressive this camera really is. The EX-F1 can take 60 full resolution (i.e. BIG) photos per second! You can shoot full 1080P HD video - not just at 30fps - at 60fps! Capture high-speed videos at 300fps, 600fps or 1,200fps with a shutter speed of up to 1/40,000 of a second!

When all is said and done though, the HD video and burst-mode photo function on all Exilim models are not well suited for video analysis. To educate yourself do a search for "rolling shutter effect" on Google or Bing. Almost all webcams and hand-held recording devices such as iPhones or Flip cameras use low-cost CMOS sensors that record video in a way that causes skew and the shaft will look like a wet noodle. Even though the Exilims record high-def video, most of the time you will be recording swings at the lowest *high-speed* frame rate the camera offers. This will be 120fps, 210fps or 300fps depending on the model.

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*You can get a fairly affordable lighting solution if you purchase T5HO fixtures or Lowel 750w TOTA light kits. You'll pay about $250-$300 per kit for either solution and will need a minimum of two kits.

Casios vs. HD Camcorders:

Many instructors think an HD camcorder will give them the best experience when recording swings. It seems like common sense that a larger picture will be more clear. It is, but most HD camcorders don't have an adjustable shutter speed setting so anything moving fast in the video will blur. They have the rolling shutter problem mentioned earlier, particularly at full 1080P HD. There is no live video output to the computer so swings cannot be automatically trimmed and stored. Furthermore, the video sizes are huge and unwieldy to work with and you only get 30 frames of video per second. HD camcorders are OK for tips and drills but I have not found an affordable one yet that I would recommend for video analysis.

Casios vs. Standard Definition DV Camcorders:

For the past 9 or 10 years the standard camera used with video analysis programs was the DV or miniDV camcorder. (Aside: MiniDV refers to the small "mini" tape the camcorder stored the video on, not the size of the camera.) The advantage this camera offered was that it eliminated the need for a video capture card and allowed programs to standardize the way video was input and captured. The video was digitized on the camera and stored on tape or was streamed via Firewire directly to the computer. This allowed for automatic capture and trimming of the captured swings using some triggering device like a microphone.

A little known fact among teaching pros was that when you captured video at 60fps from a DV camcorder you actually were only getting ½ of a picture. This half picture was called a field (odd or even) and normally an odd and even field would be combined to make a full picture – a "frame" of interlaced video. Analysis programs kept these fields separate to offer 60 pictures per second but the pictures were actually the odd or even fields that were stretched from 720 x 240 pixels to 720 x 480 pixels by the program to make a full picture.

For this reason while videos from the Casio are smaller (512 x 384 at 300fps on the EX-F1) they are actually better quality than traditional DV camcorders because they take a full picture for each frame of video rather than stretching a field to make it into a full frame.

Casios vs. Webcams:

Due to the rolling shutter issue caused by inexpensive CMOS sensors and lack of shutter speed control most webcams are not recommended. It is possible to find specialty "global shutter" (i.e. take the whole picture at once vs. line by line) webcams that will work if you do some research. Even older Logitech cameras and Philips cameras like the SPC900NC could be used with passable results. With the advent of USB3 (aka "Super Speed USB") more webcam choices will emerge so please remember if you don't see "global shutter" advertised and you can't adjust the shutter speed you don't want it!

Casio vs. Casio

It's decision time. Which Casio Exilim is the right one to buy? I'll quickly narrow the review down to two models and give you the pros and cons of each. The models we will eliminate right away are the FC100 and the FH20. The FC100 has no manual shutter control so it can be ruled out. The FH20 can also be ruled out. It is a good camera but the updated FH25 has all the same features and more. Below are frames taken from the four models.

These pictures are unaltered except for sizing. All are shot at 1/2000th of a second except the FC100

which does not have manual shutter adjustment. You will notice the new FH25 picture is larger and clearer. That is because the actual video is 640x480 at 120fps, a full 33% larger than the other Exilim models.

A Disappointing Truth:

As much as I hate to admit it even the Casio Exilims suffer a rolling shutter effect which means the shaft will appear bent at certain points even though it is not. The effect is more pronounced at lower frame rates. Recording tests using The Speed Stik (which is extremely rigid) I found an 80mph swing produces about 4"-5" of shaft deflection at impact with a video recorded at 120fps. At 210 frames shaft deflection is cut in half to 2.5". At 300fps there is about a 2" deflection and at 420fps it becomes hard to detect. These numbers represent a worst case scenario as the videos shot were fairly tight on the shaft to maximize the effect. In the real world 16 feet away from a player recording at 300fps you probably won't even notice any deflection, but you should be aware the problem exists.

EX-F1 Pros and Cons:

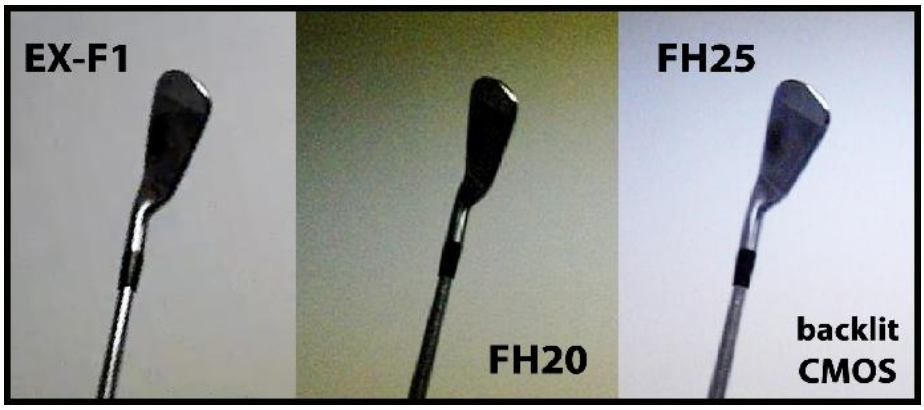
The EX-F1 has some distinct advantages over the FH25.

- Microphone input. If you plan on using it to make a tips & drills DVD or other presentation you need a mic input on the camera to get good audio quality.
- The video file sizes are much smaller. The compression used for QuickTime .mov files is much more efficient resulting in file sizes that are are about 6x smaller than the same video shot on the FH20 or FH25. A swing on the F1 will be about 8 or 9MB. The same swing on the FH25 would be 40-45MB. This means you can fit 6x more swings on your computer and files will transfer faster from the camera to the computer. If you are using one of the new Eye-Fi Pro x2 cards your files transfer much faster and your memory card won't fill up as fast.
- The EX-F1 is the ONLY camera with a live connection to the computer. With all models except the EX-F1 you have to record videos to the SD memory card on the camera and then transfer them to the computer to view them. The EX-F1 offers the ability for the computer to send commands to the camera and transfer files directly to your computer. A program currently on the market allows users to capture multiple angles (up to 26) simultaneously using the EX-F1.
- Offers a few features like full 1080P HD video at 60fps or bracketed photos that the other models do not.
- Besides the higher $1,000 cost the only downside to the EX-F1 is that it records videos in the QuickTime .mov format which some analysis programs cannot use without converting the videos to another format prior to viewing. One program, SwingView Pro, is built around using the Exilim cameras and handles .mov files without conversion and automatically synchronizes videos with different frame rates (i.e. a 300fps video will sync with a 60fps model).

EX-FH25 Pros and Cons:

The FH25's main appeal is the lower price point and ease of use. For the money it's a good deal.

- Lower $350-$400 price point.
- Records videos in the .avi format which all video analysis programs support.
- Simple to use. Just one recording button with all controls easily accessed on the cameras LCD screen. The LCD on the FH25 is 3" and slightly larger than the EX-F1's 2.8" LCD.
- The field of view is wider than the EX-F1 which means you can record a full swing from about 10' away vs. 16' for the EX-F1 but there is no provision for a wide-angle lens as there is with the EX-F1.
- The FH25 has a 120fps capture mode which produces a beautiful 640 x 480 picture, 33% larger than the EX-F1 at 300fps.
- Features a 20x optical zoom vs. 12x on the EX-F1 with a better 10MP still picture resolution.
- The electronics from the original FH20 were moved and a new back-illuminated CMOS sensor is used that is more sensitive to light. You can see the difference in the comparison picture below where all conditions and settings are the same.



Summary:

We are in a transition period between technologies. The overwhelming majority of the cameras you can purchase in stores do not have manual shutter adjustments and record to hard drives or memory cards. They make editing easy but are not suited for sports motion analysis. DV camcorders and Firewire are being phased out and the new USB3 spec is sure to inspire plug-and-play devices in the coming year that will be of interest.

At present the Casio Exilims offer the best way to affordably capture high-speed video. Even though they have a slight rolling shutter issue that skews the shaft the effect is minimal at higher frame rates. If budget is a concern and you don't mind capturing and cutting & pasting videos from the memory card to your computer, the FH25 is an excellent choice. If you need live or multi-camera capture the EX-F1 should be your camera of choice. Either way you go the Exilims are worth the investment.

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