

Canon

**EOS
DIGITAL**



**GETTING THE MOST
FROM YOUR EOS-1
CLASS DIGITAL SLR**

TIPS AND TECHNIQUES:

**CAMERA HANDLING
& MAXIMUM IMAGE
QUALITY**

OVERVIEW

Canon's EOS-1 class digital SLRs (EOS-1D, EOS-1Ds, EOS-1D Mark II and EOS-1Ds Mark II) are clearly the company's highest quality and most powerful digital SLRs to date. Thanks to their key attributes of EF Lens compatibility, Canon CMOS sensor technology and DIGIC/DIGIC II Image Processors, EOS-1 class digital SLRs produce images with exceptionally low noise, excellent detail and superb color.

As with any professional camera system, there are numerous variables in camera operation, lens selection and image quality optimization that must be clearly understood and mastered by the user in order to achieve the best possible results. The purpose of this document is to identify the factors that affect the autofocus (AF) performance and image quality aspects of EOS-1 class digital SLRs, and provide tips and techniques on getting the most out of this powerful camera and lens system.

We have intentionally provided detailed explanations to clarify the reasoning behind our recommendations, but at the beginning of the document there is also a brief summary of the main points for your convenience. Thank you for using Canon products! We want you to know that we sincerely appreciate your patronage.

QUICK REFERENCE GUIDE

Camera Operation Tips **Select focusing points manually:**

Selecting the focusing point manually speeds up the autofocus system because the camera does not have to decide which focus point or points to use. Manual focusing point selection also allows you to control exactly where the camera is focusing. If you would like to select two focusing points at once, you can shift the focusing point up or down one row.

Use Custom Functions to improve AF control and speed up camera operation:

- C.Fn 4 operates AF and shutter release separately for greater control.
- C.Fn 13 speeds up focusing point selection by reducing the number of manually selectable focusing points.
- C.Fn 17 expands the active area around manually selected focusing points. (For maximum control, use C.Fn 17-0 to disable focusing point expansion.)
- C.Fn 19 adds AF control features to compatible EF lenses.
- C.Fn 20 provides more control over AI Servo focusing sensitivity.
- C.Fn 21 controls the priority of framing rate over predictive AF.

Custom Functions can be combined to optimize camera operation according to various applications such as Action Photography and Event Imaging. Groups of Custom Functions can be saved in the camera and selected quickly when needed.

Try to find a point on your subject with a high degree of contrast:

A contrasty subject is easier to focus on. This is particularly important in low light. If your subject is low in contrast, try focusing on its edge rather than in the middle.

Avoid recomposing after focus lock during portraiture or close-up photography:

This technique can cause focusing errors when shooting subjects within 15 feet of the camera, especially when using large apertures to reduce depth of field. Instead, select an off-center focusing point or focus manually.

For maximum AF Speed, use current USM lenses and avoid Extenders:

Current USM lenses such as the IS super-telephoto series are optimized for maximum AF speed when used with EOS-1 class digital SLRs. In exchange for increasing focal length, EF Extenders reduce lens drive speed and maximum apertures.

Practice your shutter release technique:

Pressing the shutter button halfway prior to shutter release improves AF tracking accuracy and shutter button response, especially in AI Servo AF with moving subjects. It can also reduce the potential of camera shake.

Avoid unintentional motion blur:

Assuming an accurately focused subject, you can maximize image quality by eliminating unwanted motion blur. To reduce the effects of camera shake, use a tripod when possible. Use an Image Stabilizer lens for handheld photography. To eliminate unwanted blur caused by subject movement, use faster shutter speeds or electronic flash.

Avoid inadvertent camera or subject movement after focus lock:

If you are using One-Shot AF, do not move the camera towards or away from the subject after locking focus, especially for subjects within 15 feet of the camera.

Avoid the use of small apertures with wide-angle or wide zoom lenses:

Small apertures can cause sharpness-degrading diffraction when using wide-angle or wide zoom lenses.

**Image Quality
Optimization Tips**

Consider the use of in-camera sharpening:

If you shoot JPEGs and you wish to reduce or eliminate the need for post-processing in order to speed up your workflow, you may find that increasing the level of in-camera sharpening is effective.

Apply post-process sharpening effectively:

Canon EOS digital cameras have an anti-aliasing filter installed on the image sensor. This filter improves color rendition and practically eliminates moiré. The liability is a slight reduction of sharpness. To reduce the softening effect of the anti-aliasing filter we recommend applying an unsharp mask to the image in Adobe® Photoshop®. Although there is no such thing as a “best” setting for all applications, we suggest the following as a starting point:

Amount: 300%

Radius: 0.3 pixels

Threshold: 0 pixels

Understand that image magnification affects perceived sharpness:

When viewing images at 100% magnification, the actual image size can be as large as 4 x 6 FEET depending on the resolution of the camera. If your images are regularly printed at 8.5" x 11" or less, the equivalent magnification with EOS-1D Mark II would be approximately 33%, or 25% with an EOS-1Ds. Try printing your images to evaluate sharpness.

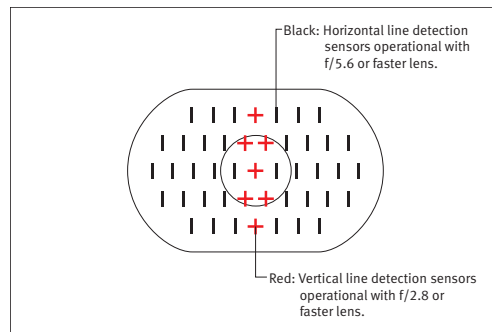
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I. CAMERA FEATURES AND OPERATION

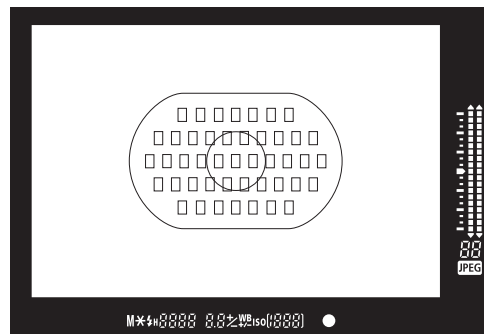
45-point Area AF Sensor

EOS-1 class digital SLRs use an improved version of the 45-point Area AF CMOS sensor unit that was originally introduced in 1998 with the EOS-3. The pixel density and layout of sensor elements together with the patented design of the camera's sub-mirror and separator lenses gave rise to the name "Area AF" and resulted in a coverage area of 8 x 15mm with 45 selectable focusing points. (Previous EOS AF designs had 5 points or fewer, all in a single line.) When the camera is oriented horizontally, all 45 points are sensitive to horizontal or diagonal subject contrast with lenses featuring maximum apertures as small as f/5.6. Six of the central-area focusing points become high-precision cross-type sensors when the lens has a maximum aperture of f/2.8 or larger. The central focusing point is high-precision cross-type with f/4 or faster lenses, and can maintain single-line autofocus with maximum apertures as small as f/8. These factors can come into play when choosing lenses and extenders for maximum AF performance.

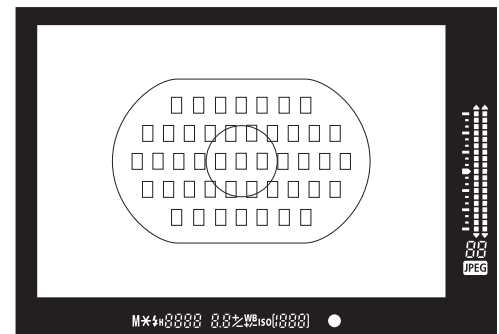


AF Frame

The focusing area is 8 x 15mm regardless of the camera's imaging format. Consequently, AF coverage is proportionately larger with the EOS-1D and EOS-1D Mark II with their 19.1 x 28.7mm imaging format than it is with the EOS-1Ds Mark II, EOS-1Ds, EOS-1v or EOS-3 which feature 24 x 36mm coverage.



EOS 1Ds Mark II

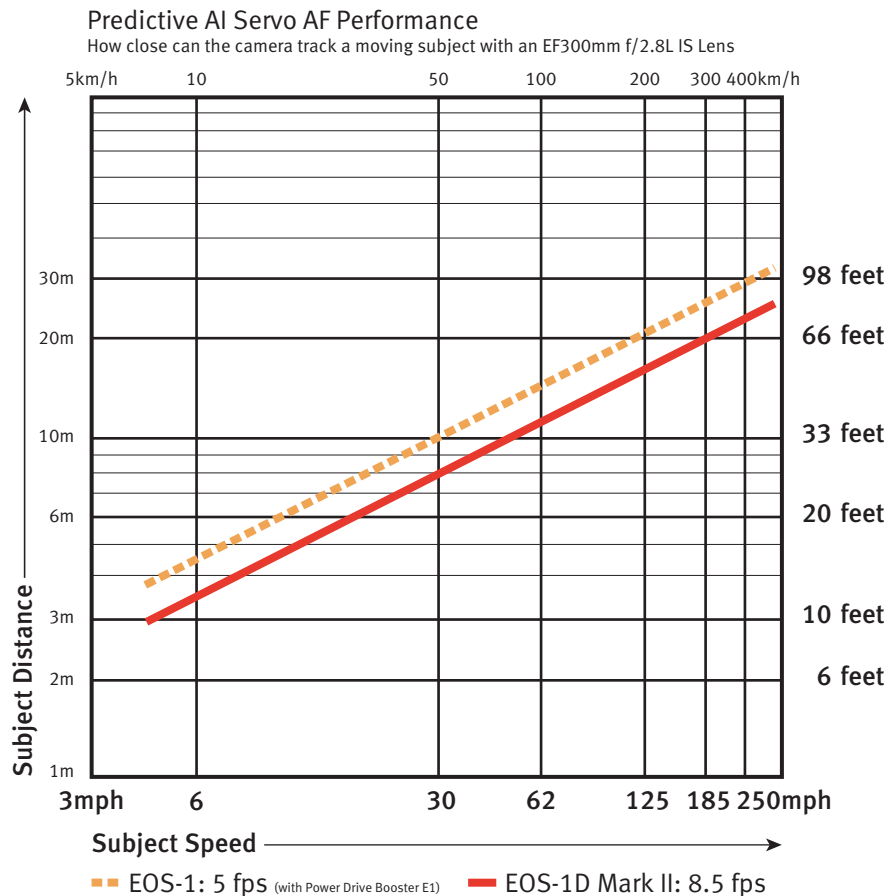


EOS 1D Mark II

The Evolution of AF Speed & Predictive AF Control

The EOS-1D and EOS-1Ds had the fastest AF systems available among EOS SLRs when they were introduced, but the EOS-1D Mark II now has the most powerful AF system of any EOS camera released to date (2004). The EOS-1D Mark II was the first Canon camera to feature two dedicated CPUs for AF: one for detection and calculation, and another to control lens drive. EOS-1 class cameras prior to the 1D Mark II used a single dedicated CPU for all AF operations.

All EOS-1 class digital SLRs feature RISC (Reduced Instruction Set Computing) processors so that multiple operations can be performed simultaneously. The extra speed created through this method has made it possible to increase the power and sophistication of the algorithms employed for predictive AF. Using an EF 300mm f/2.8L IS USM lens and a fully charged battery pack, the original EOS-1 with Power Drive Booster PB-E1 could track a subject moving at 300 kph/186 mph as close as 26 meters/85 ft. Using an EF 300mm f/2.8L IS USM lens and a fully charged battery pack, an EOS-1D Mark II or EOS-1Ds Mark II can track a subject moving at 300 kph/186 mph as close as 20 meters/66 ft.



AF Modes **One-Shot AF:** This mode is intended for use with stationary subjects. It locks focus upon completion of lens drive, allowing the photographer to recompose if desired. One-Shot AF is also recommended for maximum performance in extreme low-light situations.

AI Servo AF: This mode is intended for use with moving subjects. It operates continuously up to the instant of exposure, and it also operates between exposures in burst mode shooting.

In AI Servo AF, you can tell whether the AF system is tracking the subject by observing the focus indicator in the viewfinder below the picture area. If the focus indicator does not light, the system is tracking. If it is blinking rapidly, the system is not tracking. Please note that this is slightly different from the camera's behavior in One-Shot AF. In One-Shot, the focus indicator still blinks when the subject can't be focused, but it lights up continuously when focus has locked.

AF Point Selection Methods Canon provides two AF point selection methods: Automatic and Manual. The details of each method are described below.

Automatic Focusing Point Selection (AFPS): The camera selects a focusing point for you, choosing from all 45 points. AFPS behavior varies according to your choice of focusing modes:

- When **One-Shot AF** is combined with AFPS, the camera typically selects the closest subject with readable contrast. Since the subject may be large enough to cover several focusing points simultaneously, the viewfinder's focusing point display may illuminate as many as 13 points simultaneously. If focus cannot be achieved, the in-focus indicator below the picture area blinks.
- When **AI Servo AF** is combined with AFPS, the camera shuts off all focusing points except the central one until the subject has been identified. Once the camera has started to track the subject with the center point, all 45 points are activated and the camera is able to track movement not only towards or away from the camera, but anywhere the subject moves within the 45-point coverage area.

Manual Focusing Point Selection (MFPS): The photographer selects the desired focusing point. When the camera is set to its defaults, only one or two focusing points are used. (To select 2 focusing points at once manually, use the Quick Control Dial to scroll up or down from the currently selected manual focusing point. When 2 focusing points are active, the camera evaluates both and selects the one with the most reliable subject data. This can come in handy when photographing moving subjects.) The active area around a manually selected focusing point can also be expanded in two stages via Custom Function 17. [See Custom Functions](#) for details.

When the camera is set for MFPS, the manually selected focusing point illuminates in the viewfinder display when the shutter button is pressed halfway. This occurs in both One-Shot AF and AI Servo AF. The illumination can be turned off or made brighter with Custom Function 10.

The AF system tends to work slightly faster when the focusing point is manually selected than during AFPS, but there is a trade-off between the wider coverage area of AFPS and the comparatively narrow coverage area of MFPS. Choosing between the two is largely based on subject matter, lens selection and personal preference.

AF Performance According to Subject Contrast & Detail

The 45-point AF sensor used in current EOS-1 class cameras has been engineered to perform as well as possible with low-contrast subjects. However, the sensor is part of a passive AF system that requires certain levels of light and subject contrast or detail in order to function at all. For example, the camera will not focus in complete darkness or on a blank wall or sheet of paper unless it has the benefit of an AF-Assist beam to project a striped pattern on the subject. (When you're using Speedlite Transmitter ST-E2 or an EX Speedlite, be sure to set the camera to One-Shot AF to activate the AF-Assist beam.)

Low-contrast subjects are not limited to blank walls and sheets of paper. Typically, you will find subject matter such as human skin and various types of single-color clothing to be low in contrast as well. Additionally, the veiling glare sometimes encountered when photographing backlit subjects can degrade subject contrast when it is being evaluated by the camera's AF sensor. In such cases, we suggest that you try to focus on the edge of the subject rather than in the middle of it.

As a photographer you will not always have complete control over your shooting position, lighting direction or the detail and contrast in your subject matter. Nevertheless, you need to be aware that AF performance is affected by the contrast levels presented to the focusing sensor.

AF Performance According to Light Levels

Assuming adequate subject contrast, autofocus speed in the EOS System is largely dependent on the following factors:

- **Light Levels:** The darker it gets, the longer it takes for the AF system to lock on to the subject, regardless of the lens in use.
- **Maximum Aperture:** In low light conditions, the faster the lens, the faster the AF, generally speaking. For instance, in low light, an EF 35mm f/1.4L USM will autofocus faster than an EF 28-135mm f/3.5-5.6 IS USM lens.
- **Focal Length:** Longer focal length lenses like the EF 70-200mm f/2.8L USM have a much greater range of defocus than standard or wide-angle lenses. In other words, when an image goes out of focus on a fast telephoto lens, it really goes out of focus. This can cause delays or sometimes even failures in low-light AF. As a workaround,

focus manually until you are “in the ballpark,” then try using AF for fine-tuning. Additionally, this is an instance where the distance range selector switch on “white” lenses like the EF 70-200mm f/2.8L USM can reduce the length of time the AF system spends hunting for focus, if your subject distance happens to be beyond the range stated on the lens switchboard.

In **One-Shot AF**, it can take as long as a full second or more for the camera to achieve focus completion in extremely low light without a focusing aid. Even with a Speedlite featuring an AF-Assist beam, low-light AF will be slower than bright-light AF. This is not a design flaw or manufacturing defect; it’s related to the sensitivity of the AF sensor. Remember that the AF system is always passive, even when using an AF-Assist beam; AF search in low light can be faster with an AF Assist beam than without one, but bright light AF speed will always be faster with a readable subject.

In **AI Servo AF**, the camera samples the AF detection data at varying rates of frequency depending on the light level. The brighter it gets, the higher the sampling rate and therefore AF performance improves. But as light levels drop off, the sampling rate decreases and a point is reached where the tracking ability of the AF system is diminished. In other words, it’s unrealistic to expect AI Servo AF to track fast-moving subjects as well in low light as it does in bright light.

Again, you may not always have control over lighting conditions, but it is important to understand that there are limitations to AF performance according to the level of available light.

Shutter Release Techniques: Half-Press vs. Mash Another factor that has a lot to do with AF performance is shutter release technique. In order to achieve the greatest possible performance from your EOS camera, it is essential to press the shutter button halfway and hold it there until the instant you are ready to shoot, especially in AI Servo AF with moving subjects. No other way is nearly as effective in terms of maximizing AF performance.

There are two issues at stake here: the first is focus tracking and the second is a phenomenon known as “release-time lag” or “shutter lag.” In One-Shot AF, pressing the shutter button halfway locks the focus. When the camera is set for AI Servo AF and the shutter button is pressed halfway, the AF system begins tracking the subject. If you simply press the shutter button down without waiting for the AF to function, the shutter release might lock up or be delayed in One-Shot AF. Under the same conditions, the shutter will release without focusing in AI Servo AF. This is true with or without the use of an AF-Assist beam. Conversely, pressing the shutter button halfway and holding it there until you are ready to shoot allows the focusing system to lock focus in One-Shot AF or start tracking the subject in AI Servo AF. Pressing the shutter button down all the way once focusing has been established will release the shutter in the shortest possible time, thereby increasing the odds of capturing “the decisive moment.”

Some might think that it's a good idea to keep the shutter button half-pressed all the time, but battery life will be shortened significantly by that technique. The best balance between power consumption and AF performance is to anticipate picture-taking opportunities and do not press the shutter button halfway until just a second or two before pressing all the way for the shot.

**Autofocusing Techniques:
Off-Center Focusing Points vs.
“Focus Lock and
Recompose”**

The 45-point Area AF sensor covers a significant portion of the picture area, especially with the original EOS-1D and EOS-1D Mark II. However, many photographers never use the off-center focusing points, preferring the old-fashioned method of locking focus with the center point and then recomposing for the actual image. Before multi-point AF cameras were available, “Focus Lock and Recompose” (FLR) or manual focus were the only choices available. That's no longer the case.

FLR is sufficiently accurate for photographing distant subjects, but it can cause focusing errors, especially backfocus, when photographing subjects within about 15 feet of the camera. This is often the case during portraiture. For optimum focusing performance with close subjects, we recommend avoiding the FLR technique. Instead, use an off-center focusing point or focus manually.

**Fine-Tuning Your Camera
with Custom and
Personal Functions**

EOS-1 class digital SLRs are equipped with an extensive variety of Custom Functions (C.Fn) and Personal Functions (P.Fn) that allow photographers to tailor many aspects of camera operation according to personal preferences. Although there are minor differences in the quantity and variety of C.Fns and P.Fns according to individual camera models, most of them are consistent across the product line. For the purposes of this document, we will concentrate on C.Fns and P.Fns that affect AF performance with EOS-1 class digital SLRs.

Custom Function 4 allows the photographer to control which button on the camera is used to start or stop AF. It also ties in with AE Lock when the camera is set to an AE mode.

- C.Fn 4-0 (the default setting) starts AF and AE when the shutter button is pressed halfway. AE Locks automatically upon focus completion when the camera is set for the combination of One-Shot AF and Evaluative Metering. With other AF modes or metering patterns, AE Lock can be initiated manually by pressing the AE Lock button on the back of the camera.
- C.Fn 4-1 switches AF start to the AE Lock button, and starts AE Lock in AE modes with any metering pattern when the shutter button is pressed halfway. This mode is popular with sports photographers and some photojournalists, especially those who originally learned photography with manual focus SLRs. It works particularly well with USM lenses that have distance scales, because such lenses feature full-time manual focusing even when the lens is set for AF. With C.Fn 4-1, the photographer can manually focus such a lens at any time, and then start or stop AF independently from

shutter release simply by pressing or lifting the thumb off the AE Lock button.

- C.Fn 4-2 keeps AF start on the shutter button, but allows the photographer to stop AF temporarily by pressing the AE Lock button. AE Lock is unavailable in this mode, but it doesn't make any difference when the camera is set for manual exposure as it often is for professional sports photography.
- C.Fn 4-3 is almost the same as C.Fn 4-1, except that there is no AE Lock. This mode is useful when shooting sports photography in changing light situations, because it updates the exposure automatically in AE modes as the subject moves from shadow areas to sunlit areas or vice versa.

Custom Function 11 allows the photographer to control which buttons and dials are used to select the focusing points.

- C.Fn 11-0 (the default) initiates focusing point selection mode when the focusing point selector button is pressed. Focusing points can be scrolled horizontally with the main input dial, or vertically with the quick control dial.
- C.Fn 11-1 reverses the functions of the focusing point selector button and the exposure compensation (+/-) button on top of the camera. In other words, the exposure compensation (+/-) button initiates focusing point selection mode, and the main and quick control dials scroll the focusing points horizontally and vertically, respectively. During photography, C.Fn 11-1 makes it quick and easy to adjust exposure compensation by rotating the main dial while pressing the focusing point selector button.
- C.Fn 11-2 also reverses the functions of the focusing point selector button and the exposure compensation button, but during photography it allows you to use the Quick Control Dial to scroll focusing points horizontally. Focusing points can be scrolled vertically by turning the Main Dial while pressing the Assist Button. AFPS is unavailable in this mode, except when P.Fn-18 is activated.
- C.Fn 11-3 reverses the functions of the focusing point selector button and the FEL button. In this mode, the FEL button initiates focusing point selection mode, and the main and quick control dials scroll the focusing points horizontally and vertically, respectively. The focusing point selector button initiates the FEL preflash. With or without flash, C.Fn 11-3 allows ambient exposure compensation to be adjusted with the Quick Control dial during photography. C.Fn 11-3 is popular with photographers who use FEL extensively.

Custom Function 13 controls the number of manually selectable focusing points, and it also allows the photographer to link spot metering to an off-center focusing point.

- C.Fn 13-0 provides access to manual selection of all 45 focusing points and fixes spot metering at the center of the picture area, as marked by the circle at the center of the focusing screen.
- C.Fn 13-1 reduces the number of manually selectable focusing points to 11; 3 in the top row, 5 in the middle row, and 3 more in the bottom row. Spot metering and Flash Exposure Lock are linked to the manually selected focusing point in this mode. Fewer

focusing points results in faster manual selection, and linking spot metering to the manually selected focusing point comes in handy under certain circumstances, particularly with off-center subjects.

- C.Fn 13-2 also reduces the number of manually selectable focusing points to 11, just like C.Fn 13-1, except that spot metering is fixed at the center of the frame. Locking spot metering at the center can be desirable, especially in Manual exposure mode, because it allows the separation of focusing and metering.
- C.Fn 13-3 reduces the number of manually selectable focusing points to 9; 8 around the periphery of the Area AF ellipse plus the center focusing point. This is a useful option for sports photographers, because the peripheral focusing points can be selected rapidly via the Quick Control Dial.

Custom Function 17 allows the photographer to create a cluster of active focusing points during manual focusing point selection.

- C.Fn 17-0 forces the camera to evaluate only the manually selected focusing point or points. This is often the best choice when working with average subjects.
- C.Fn 17-1 expands the active focusing area by a radius of 1 point around the manually selected focusing point, creating up to 7 active focusing points. The camera always tries to use the manually selected focusing point, but when it can't, it can choose one of the other 6 active focusing points if there is readable subject detail under one of them. This option is intended to increase the odds of getting sharp photos with small, fast moving subjects such as birds in flight. However, it can sometimes cause critical focus to shift slightly ahead of or behind relatively large 3-dimensional subjects like human beings. We suggest practicing with C.Fn 17-1 repeatedly until you get a feel for what it can and cannot do in your specific applications.
- C.Fn 17-2 performs a little differently according to the camera model. With the original EOS-1D and EOS-1Ds, the camera decides whether or not to expand the focusing area by a radius of 1 or 2 focusing points around the manually selected focusing point based on the focal length of the lens in use as well as the subject's degree of movement. The photographer has no control over it other than lens selection. With the Mark II cameras, on the other hand, C.Fn 17-2 expands the active focusing area by a radius of 1 point around the manually selected focusing point at focal lengths up to 200mm, or by a radius of 2 points when the focal length is greater than 200mm, regardless of the degree of subject movement.

Note: In theory, Custom Function 17-1 or 17-2 slightly reduces AF speed because of the extra calculations involved. However, expanding the active focusing area often increases the odds of finding a readable subject when subject size is small, or low in contrast. We encourage you to experiment with all C.Fn 17 settings to determine which setting is best for your specific needs.

Custom Function 18 programs the functions of the Assist Button near the eyepiece of the camera.

- C.Fn 18-0 is the default setting. The camera can “register” (memorize) a user-specified focusing point or even automatic focusing point selection, then switch immediately to the registered focusing point by pressing the focusing point selector button and the Assist Button.
- C.Fn 18-1 lets users switch to the registered focusing point simply by pressing the Assist Button.
- C.Fn 18-2 switches to the registered focusing point only while the Assist Button is pressed. Releasing the button causes the camera to revert to the previously selected focusing point. This is useful for switching quickly between user-selected and pre-registered focusing points. For example, if you register the center focusing point and then set the camera for AFPS, you can switch between the two focusing point selection methods at will.

Custom Function 19 programs the functions of the AF Stop buttons on a select group of Image Stabilizer super-telephoto lenses including the EF 300mm f/2.8L IS USM, EF 400mm f/2.8L IS USM, EF 400mm f/4 DO IS USM, EF 500mm f/4L IS USM, and EF 600mm f/4L IS USM. It has no effect with other lenses.

- C.Fn 19-0 is the default setting. Autofocus is suspended when one of the AF Stop buttons is pressed. AF resumes when the AF Stop button is released. This is useful for sports or nature photography if an obstacle is temporarily blocking the main subject.
- In C.Fn 19-1, AF operates only when the AF Stop button is pressed. While the button is pressed, AF operation from the camera is disabled. This can be beneficial because it lets your left hand control AF operation, thereby freeing up your right hand to do other things like selecting a new focusing point.
- In C.Fn 19-2, if the AF Stop button is pressed while the exposure metering system is active, AE Lock takes effect in AE modes. This can be convenient when you want to focus and meter separately. In this mode, AF is activated from the camera.
- In C.Fn 19-3, if the camera is set for MFPS, pressing one of the AF Stop buttons instantly switches the camera to AFPS. This can be effective in AI Servo AF if it becomes difficult to track a moving subject with a single focusing point.
- In C.Fn 19-4, if the camera is set for One-Shot AF, pressing one of the AF Stop buttons temporarily toggles it to AI Servo AF, and vice versa. This can be effective when working with a subject that stops and moves frequently.
- In C.Fn 19-5, if the lens’ IS switch is on, the Image Stabilizer operates only when you press one of the AF Stop buttons. Autofocusing must be initiated from the camera body. This option is somewhat similar to C.Fn 19-1 because it lets you concentrate on selecting focusing points and operating the shutter release with your right hand while controlling IS with your left hand.

Custom Function 20 controls the degree of focusing “sensitivity” in AI Servo AF. This is not the same as AF calculation speed, which is always done as quickly as possible. Instead, what is being adjusted is the length of time that the AF system is programmed to stay at the most recently focused distance when the original subject is no longer being tracked by the active focusing point. This can frequently happen in sports

photography when another subject or obstacle temporarily blocks the original subject. The default setting is 0.5 seconds, but with this Custom Function it can be tweaked faster or slower according to the photographer's personal preference.

- C.Fn 20-0 is the camera's standard setting. It programs the AF to remain at the most recently focused distance for up to 0.5 seconds while an obstacle is blocking the original subject.
- C.Fn 20-1 ("Slow") programs the AF to remain at the most recently focused distance for up to 1 second while an obstacle is blocking the original subject.
- C.Fn 20-2 ("Moderately Slow") programs the AF remain at the most recently focused distance for up to 0.75 seconds while an obstacle is blocking the original subject.
- C.Fn 20-3 ("Moderately Fast") programs the AF to refocus on a new subject approximately 0.25 seconds after the original subject is no longer being tracked.
- C.Fn 20-4 ("Fast") programs the AF to refocus on a new subject approximately 0.125 seconds after the original subject is no longer being tracked.

In C.Fn 20-3 and 20-4, the lens focusing motor may seem more "jittery" than usual as it constantly refocuses the lens. This is normal.

Custom Function 21 first appeared with the EOS-1D Mark II. It is the same as Personal Function 13 from the EOS-1D and EOS-1Ds. The purpose of this setting is to control the camera's shutter release timing during continuous bursts in AI Servo AF. In all cases, release timing for the first shot is controlled by the photographer, and the camera will fire whether or not the subject is in focus. This is called "Release Priority," as opposed to "Focus Priority," in which the camera does not fire until the AF system has confirmed that the subject is in focus.

- C.Fn 21-0: Focus Priority within a prescribed time limit* for the second and subsequent shots in a continuous burst with AI Servo AF.

* The shutter will release at the framing rate set by the photographer, as long as lens drive can be completed within a prescribed time limit. The shutter releases at the end of the prescribed time limit, even if focus has not been achieved.

- C.Fn 21-1: Release Priority for the second and subsequent shots in a continuous burst with AI Servo AF.

Some photographers prefer C.Fn 21-1 because it ensures that the camera will fire at a consistent framing rate, even though it means that the subject may not be accurately focused. However, this is clearly a "use at your own risk" scenario, because there is no way to be sure that your photos will be sharp.

Personal Function 14 disables focus detection ("hunting") by the lens drive. This can save time in low light or low contrast situations, especially when working with a USM lens equipped with a distance scale. Such lenses can be focused manually even when set to their AF mode.

Personal Function 15 disables the AF-Assist beam of compatible EX-series Speedlites. This can be helpful when working with other photographers, to prevent your AF-Assist beam from appearing in their photos. The downside is that you lose the benefits of the AF-Assist beam for your own photos.

Personal Function 16 allows the camera to fire automatically when autofocus is achieved and the shutter button is fully depressed. This can be effective for handheld macro photography or when the camera is set for remote operation and waiting for the subject to come into the field of view. Remote operation can be achieved by using Remote Switch RS-80N3 or Timer Remote Controller TC-80N3 with or without one or more Extension Cord ET-1000N3 sets to release the shutter.

Personal Function 17 disables AFPS. This function can be convenient when you are manually selecting focusing points near the edge of the Area AF ellipse but don't want the camera to switch to Automatic Focus Point Selection mode.

Personal Function 18 enables AFPS when C.Fn 11-2 has been set. (AFPS is normally disabled in C.Fn 11-2 as mentioned earlier.)

**Combining
Custom Functions:
Advanced Operations**

As you can see from reading the section on Custom Functions, there are a great many C.Fns that relate to the navigation of the EOS-1 class 45-point Area AF sensor. Used individually they can go a long way towards simplifying and easing the operation of the camera. As an example, C.Fn 4-1 (or, 4-3), where the rear (*) button is used to activate the focusing system, is almost universally accepted by professional photographers as the best way to shoot sports. But by combining this function with C.Fn 18-2 and registering a Home Position (HP) with the Assist Button, it can be a much more valuable and versatile tool.

We will look at a few combinations and how they relate to different types of photography. A combination that's useful for sports may be frustrating for shooting a wedding or event, whereas a different combination might be ideal for those applications. Some combinations lend themselves better to photographers who shoot in AI Servo AF, but others make more sense for One-Shot AF. We will begin by covering the Assist Button.

Assist Button

Out of the box, the Assist Button really doesn't do much and is often overlooked or not recognized as the very functional tool that it is. The key feature of the Assist Button is that you can register it to do something (with Personal Function 6, for example, you can use it to toggle back and forth between a pre-registered shooting mode and metering pattern that are different than the settings you are currently using). Here we will be using it to pre-register either individual focusing points or AFPS. This pre-registered focusing point (or AFPS) is called the Home Position (HP).

Assigning the Home Position (HP)

Use the normal method for choosing either a specific focusing point or AFPS. When you've made your selection, hold in the Assist Button and simultaneously press the FEL button near the Shutter Release. The LCD panel on the top of the camera should now confirm the registration of that focusing point by displaying the letters HP until you've taken your finger off the FEL button.

Using the Assist Button

C.Fn 18-1 and 18-2 make it easier to recall the registered focusing point(s) via the Assist Button. When C.Fn 18-1 is set, the HP focusing point can be recalled simply by pressing the Assist Button. When C.Fn 18-2 is set, you can toggle back and forth between the currently selected focusing point(s) and the HP focusing point(s).

Combinations

These sample combinations are named only for the sake of clarity. There is no reason that the "Action Combo" couldn't be used during an event (e.g., the bride walking down the aisle at a wedding), or the "Event Combo" at a football game to shoot crowds or sideline images. The idea is to choose a combination, or invent your own combination, that allows the camera to become such an extension of you that your interaction with it becomes transparent. You want to be concentrating on your subject, not on your camera controls.

Event Combo

This is probably the most useful combination of Custom Functions for wedding and event photographers. Where this method makes the most sense is when you are shooting in crowds where a lot of people are interacting – conversation groups, tables, and parties. This is a versatile combination that allows the photographer a great deal of flexibility and decision-making ability on-the-fly without taking the eye from the viewfinder. Along with this versatility comes a small level of complexity, but this complexity falls mainly in the explanation of how to use it, rather than in its actual use.			
Shooting Situation Examples	AF Mode <i>Focus Activation button</i>	C.Fn Set	Function
Weddings, receptions, events, parties, portraits, scenery, nature, etc.	One-Shot <i>Focus Activation with Shutter release button</i>	11-2	Swaps functions of Quick Control Dial (QCD) with that of the AF Point Selection Button.
		13-3	Limits AF point selection to 9 (8 peripheral AF points, and the center AF point).
		17-1 (optional)	This expands the AF activation area if needed in lowered contrast situations.
		18-1	This activates the Assist Button and pre-assigns the Center AF point as the HP.

Background

Traditionally photographers have used the FLR (focus, lock, recompose) method when interfacing with their camera and their subject. This is how it had to be done with manual focus cameras and the early auto-focus models with a single focusing point. Almost everyone knows how to use FLR, but it can cause problems. First, it's not nearly as fast as some of the methods we'll discuss here. Metering is less precise, particularly flash metering. Additionally, it can lead to backfocusing problems when shooting at wider apertures within 15 feet of the subject.

The fastest and most accurate way to work is to compose first and then use the benefits of the 45-point Area AF sensor to get your focusing and metering settings.

By using this Event combination, the photographer obtains many focusing options, all without having to take attention away from the subject. It also allows the scene to be composed in the viewfinder prior to choosing a focusing point. This is helpful because in shooting these types of events, people are unpredictable in their movements and with a quick flick of the thumb the photographer can be ready for any rapidly changing shot without having to lock focus and recompose. Compose the shot, and then just pick the point that works best.

Another advantage is that when using this combination of settings with Evaluative Metering, the camera will give more precise metering for your intended subject and do a better job of automatically compensating for backlighting and unevenly lit scenes.

For EOS-1D and EOS-1Ds cameras that use E-TTL (not the newer E-TTL II), this combination will also give you much more reliable flash exposures when you've chosen a focusing point that lands on your subject, rather than using FLR.

It will take some practice to break the habit of FLR, but once you learn how to use the 45-point AF system effectively, it can really improve your performance as a photographer.

Operation

Turn the QCD on the back of the camera to "roll" from AF point to AF point along the outer periphery of the AF Area ellipse. Tap the Assist Button to immediately go to the center AF point (this combination has automatically assigned the center point as the HP). To get off the center point and back to an outer AF point, simply use the QCD again.

This combination affects the focus point selection method only, not the focus activation. Actual focusing is done by pressing the shutter release halfway.

Hidden Feature: To get back to AFPS immediately... while holding the shutter release in the halfway position (SW-1), tap the AF Point Selection Button and release. The camera will stay on AFPS until you either use the QCD or tap the Assist Button. This is useful because generally, in well over 50% of shots in a wedding or event type environment,

the main subject is the closest and most prominent object in the frame and, in One-Shot, this is where AFPS works best.

The Bonus Feature is that the QCD is now part of your focusing system rather than your exposure control. The exposure controls are relocated to the AF Point Selection Button. Hold the selection button in and turn the Main Dial on top of the camera to adjust exposure compensation in AE modes, or f/stops in Manual mode. The disadvantage of having these exposure features on the QCD was that it made it very easy to change exposure settings accidentally. Now, it's just as fast to adjust your exposure settings, and you are far less likely to change them accidentally.

Action Combo

This combination is most useful for sports and wildlife photographers. Like the Event Combo, it provides a great deal of versatility and on-the-fly decision-making ability for photographers, especially for those who shoot rapidly moving subjects in AI Servo AF.			
Shooting Situation Examples	AF Mode <i>Focus Activation button</i>	C.Fn Set	Function
Sports, Wildlife, Birds Single AF Point – Football, Soccer, Hockey, Wildlife AFPS – Baseball, birds in flight, wildlife in the open	AI Servo <i>Rear Button AE Lock (*) focus activation – and Assist Button</i>	4-1 or 4-3	Moves focus activation from the Shutter release's halfway position (SW-1) to the camera's rear AE Lock button (*). C.Fn 4-3 is probably a bit better in rapidly changing shooting situations like this because it takes the meter reading in real-time at the moment of exposure and can adjust when a subject moves from one lighting condition to another (e.g., a player running from shade into the sun). Each image in a sequence is metered separately. C.Fn 4-1 will lock the metering for all shots to the setting used for the first image in the sequence when using continuous drive. This is useful if you're shooting a sequence in even lighting where multiple images may be printed or shown together.
		17-1 (optional)	This expands the AF activation area if needed in lowered contrast situations.
		18-2	Activates the Assist Button as a focus activation button using the photographer registered HP.

Background

Both AFPS and Single Point AF are useful in shooting sports. A single point is generally best in team sports like football, basketball, soccer, and hockey. AFPS is good for sports like baseball, some track and field, and many individual sports like skiing, skating, etc. AFPS is also useful in team sports like football or soccer where the player has broken free of a large pack and the main scene is composed of only one or two players.

Like sports, wildlife photography has situations where different focusing methods are helpful. AFPS for birds in flight, single running animals in the open; and Single Point AF for birds in a tree or nest, or animals lurking in woods or tall plants.

The idea here is that the photographer can make that call on-the-fly while shooting, rather than trying to anticipate prior to bringing the camera to the eye what method would be best.

Most sports shooters prefer to use a rear button on the camera for focusing rather than using the shutter in its halfway position. There are several advantages to working this way.

- The photographer can capture focus on the subject well in advance of shooting the image without worrying about pre-metering or accidentally firing a shot.
- The camera can stay in focus on a single subject for longer periods of time (e.g., waiting for a batter to swing) and when ready, the photographer can shoot with better camera responsiveness.
- While pressing the AE Lock button in this mode, you have AI Servo tracking focus. Let go of the button and you are now locked at that distance (as if you were in One-Shot). And with Canon EF lenses that have Full-Time Manual focusing, including all USM lenses with distance scales, you now have manual focus... all three focusing options available without having to take your eye from the finder.

Operation

Assign AFPS as your Home Position (HP). Then go back and set any single or double focusing point with the AF Point Selection Button. Most photographers would probably set the center point depending on what they're shooting, but any focusing point can be selected if it's compositionally more pleasing.

Now you have two buttons on the back of the camera that activate focus. When you look into the finder you will see the single or double AF point you've chosen. Hold in the AE Lock (*) button with your thumb and the camera will servo focus at that point. Or, hold in the Assist Button and the camera will servo focus using AFPS (see information on AFPS with AI Servo earlier in this document). Or, focus the lens manually at any time.

In this way, you can choose, while looking at your subject through the viewfinder, which method is more effective or appropriate to that subject without the distraction of taking your eye off the subject.

General Purpose Combo

<p>This isn't really a combination, except that we included C.Fn 17-1 as an option so it's a little more reliable when you're using a single focusing point in poor lighting. But, it is a very useful combination of settings because it gives more versatility to the photographer.</p>			
Shooting Situation Examples	AF Mode	C.Fn Set	Function
	<i>Focus Activation button</i>		
General photography	AI Servo or One-Shot	18-2	While being pressed, changes the focusing points or pattern that the camera uses to the HP setting. Release and the camera defaults to the method chosen by the photographer.
	<i>Focus Activation with Shutter release button</i>	17-1 (optional)	This expands the AF activation area if needed in lowered contrast situations.

Background

Many photographers are more comfortable using the shutter release to initiate autofocus, but some still want the ability to change focusing methods quickly.

This is very much like the Action Combo, but it's probably better suited to all-purpose shooting; and it also lends itself to both One-Shot and AI Servo AF settings.

Operation

Decide how you will most often choose the focusing points (AFPS or Single Point AF). Whichever method you will use less often, assign to the Assist Button as a HP. Then set the more often used method using the AF Point Selection Button.

Photographers who use AFPS most of the time can set the HP to a single point (center for those who might shoot some action, or off-center for those who shoot occasional vertical portraits). Sports shooters could use a single point most of the time and register AFPS as their HP for an alternative.

Shoot normally with your chosen focusing point selection method. While holding in the Assist Button, you will have your pre-registered focusing point or AFPS. Let go and you're back to your normal method.

Summary

Practice with these three combinations to get a feel for them. Trying these Custom Function combinations will give you an idea of what some of the settings are capable of

and let you experiment knowledgeably with other combinations that might be better suited to your specific needs.

Personal Function 00

Once you get a combination of Custom Functions that works best for you, it can then be saved (along with any other C.Fns you use) as a Custom Function Group by registering it with Personal Function 00. P.Fn 00 has the ability to register up to three different groups of Custom Functions, so you can have one group for sports, one group for events, and another for everyday shooting. This allows you to quickly switch from combination to combination based on what you're shooting without having to remember what C.Fn numbers need to be set. P.Fn 00 can be set in-camera, without having to be tethered to the computer like the other P.Fns.

To use P.Fn 00, locate the Custom Functions/Personal Functions menu on the LCD monitor. (It's the last tab on the right.) Scroll down to Personal Functions and let go of the Select button. If necessary, press the Select button again and rotate the QCD until you reach P.Fn 00. You will then have the option of registering the currently selected group of custom functions or applying a group of C.Fns that have already been registered.

II. LENS ISSUES

AF Speed According to EF Lens Vintage

Just as EOS cameras have improved over time in terms of AF calculation speed, EF lenses have improved in terms of lens drive speed. Although most if not all EF lenses regardless of vintage autofocus quickly enough to satisfy the needs of photographers who specialize in stationary subjects, there is a significant improvement in lens drive speed for fast-moving applications such as sports photography when the newer lenses are used with newer cameras like the EOS-1 class digital SLRs.

Generally speaking, all USM lenses introduced since 1999, starting with the first 4 models in the IS (Image Stabilizer) super-telephoto series (300mm f/2.8L IS, 400mm f/2.8L IS, 500mm f/4L IS and 600mm f/4L IS), autofocus noticeably faster than the non-IS versions they replaced when used with an EOS-1 class digital SLR. Therefore, if you want to experience the maximum performance of your EOS-1 class digital SLR in terms of AF speed, you must use a recent lens.

The technical reason behind the improved performance lies in new programming on the circuit board in the lens that supplies an initial burst of electrical power to the USM motor that's twice as high compared to the older lenses. The USM motor takes advantage of this extra power to focus the lens faster.

EF Extender Issues

All single focal length L-series lenses from 135mm to 1200mm plus several L-series telephoto zooms are compatible with Canon's 1.4x and 2x EF Extenders. These accessories are understandably popular among professional and advanced amateur photographers because of the extra value they offer in terms of increased focal length without forcing the photographer to invest in longer prime lenses.

Of course, there are trade-offs for this convenience. The 1.4x and 2x Extenders cost 1 or 2 f/stops respectively. This means, for example, that a 300mm f/2.8 lens when used with a 2x extender becomes a 600mm f/5.6. Additionally, EF Extenders reduce lens drive speed. As noted in the instruction sheets supplied with the Extenders, the EF 1.4x or 1.4x II reduces lens drive speed by approximately 50~67% depending on the lens in use. The EF 2x or 2x II reduces lens drive speed by up to approximately 75%. This speed reduction gives the AF system more time to detect focus. This is helpful since the depth of focus is reduced with the longer effective focal length and the chance of defocus increases. However, the reduced tracking speed and smaller maximum apertures (that sometimes result in the loss of cross-type sensor focus detection as mentioned in the description of the [45-point Area AF Sensor](#) at the beginning of this document) caused by the use of Extenders can be a disadvantage with fast moving subjects, particularly in low light.

III. IMAGE QUALITY SETTINGS

RAW vs. JPEG EOS-1 class digital SLRs allow photographers to shoot RAW files, in-camera JPEGs, or RAW plus JPEG simultaneously. The RAW file setting records image data directly from the image sensor at maximum resolution without JPEG compression artifacts, thus resulting in maximum image quality at the expense of relatively large file sizes on the memory card. In-camera JPEGs are smaller on the memory card and they can be captured at either full resolution or various lower resolution settings.

There are several other important differences between RAW files and in-camera JPEGs. Images originally shot as JPEGs are essentially “processed” in the camera as 24-bit color files according to the various camera settings for ISO speed, exposure, white balance, color space, tone curve, sharpness, contrast, saturation and color tone. With the exception of ISO speed, virtually all of the other settings listed above, including bit depth, can be adjusted during post-processing with RAW files. RAW files, therefore, offer far greater flexibility and produce image quality equal or superior to JPEGs in any reasonable comparison.

For most photographers, the choice between shooting RAW or JPEG lies in the trade-off between image quality and convenience. In-camera JPEGs are often completely sufficient in image quality for a tremendous variety of imaging applications. When the desired camera settings are made ahead of time, JPEGs can really speed up your workflow. However, RAW files preserve the highest possible image quality, and they offer a far greater degree of flexibility in terms of image manipulation.

For those who can’t decide between RAW and JPEG, or who may need both for their workflow, Canon EOS-1 class Digital SLRs also feature a RAW+JPEG simultaneous capture capability that gives you the best of both worlds, JPEGs for immediate use and a RAW file for archiving and further manipulation.

JPEG Quality JPEG quality, which is Canon’s way of referring to compression settings, can be adjusted from 1 (maximum compression, minimum image quality) to 10 (minimum compression, maximum image quality) in 1-step increments. The default JPEG quality setting for EOS-1 class digital SLRs is Level 8. In the case of the original EOS-1D and EOS-1Ds, JPEG quality adjustment is programmed in your computer and uploaded to the camera via dedicated software and the IEEE 1394 interface. With the Mark II cameras, JPEG quality can be adjusted at each of the 4 different resolution settings on the built-in LCD monitor.

The Level 10 setting for JPEG quality produces the highest image quality level for in-camera JPEGs, while Level 1 yields the highest compression ratio. The higher the compression ratio, the greater the potential for image quality degradation, and vice versa. Therefore, when preservation of fine detail is important, we recommend shooting RAW files or high-quality JPEGs. The camera's default setting for JPEG quality is more than adequate for most applications, but we suggest that you try some of the other settings to determine your "comfort level."

Another aspect of selecting JPEG quality settings is their effect on the maximum number of shots that can be taken in a continuous burst. With the Mark II cameras in particular, buffer performance improves substantially at lower JPEG quality settings due to smaller file sizes.

In-Camera Sharpness, Contrast, Saturation & Color Tone Control

EOS-1 class digital SLRs have additional image quality settings including sharpness, contrast, saturation and color tone, which can be applied to all images. In the case of RAW files, these settings can be overridden in post-processing. However, it is very important to understand that sharpness settings in particular can have a significant effect on the appearance of in-camera JPEGs, i.e., images that are shot as JPEGs in the camera as opposed to RAW files that have been converted to JPEGs in your computer.

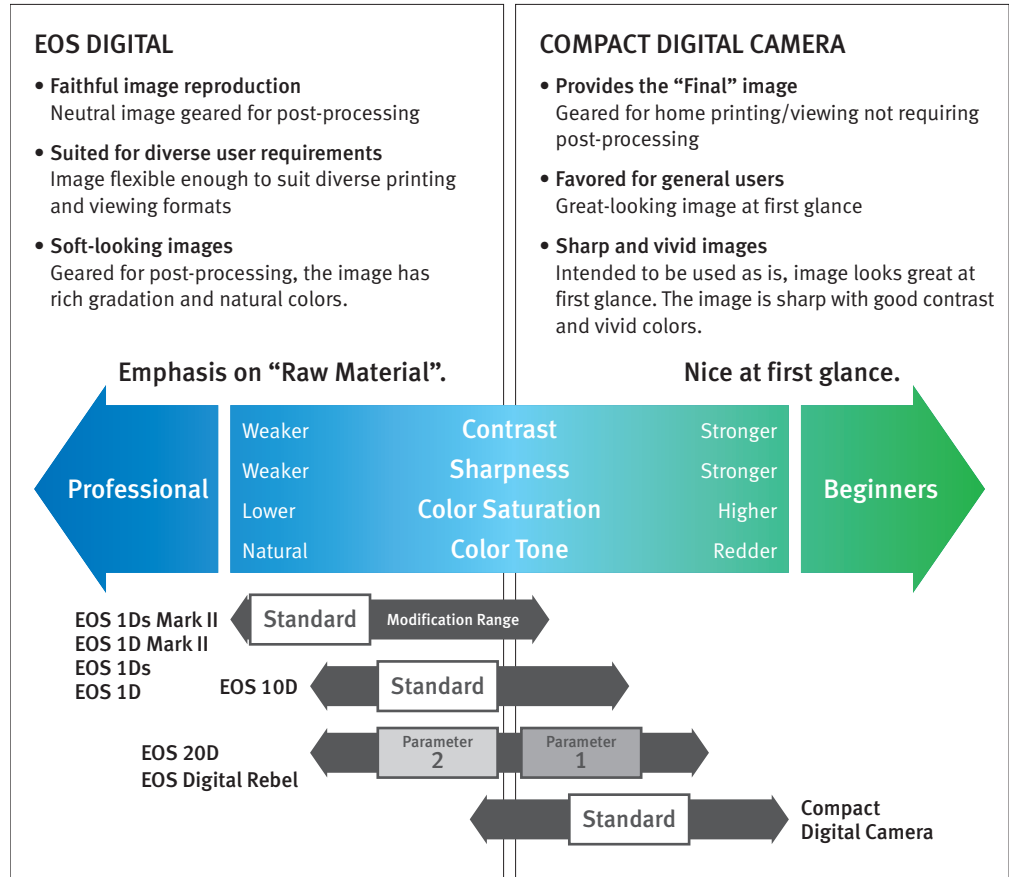
Before getting into a detailed discussion of sharpening in-camera or on a computer, it's important to realize that pictures taken on overcast days or taken indoors with only natural light look softer than pictures taken on sunny days or indoors with direct flash. Why? Because overcast day/indoor natural light pictures have less contrast than the sunny day/direct flash pictures, and pictures with less contrast look softer than pictures with more contrast. Knowing that, the contrast of a somewhat softer image can be boosted in-camera or in an image-editing program, giving the appearance of a sharper picture.

Speaking of soft images, lens flare can cause even a picture taken on a sunny day to look soft. Another cause of an apparently soft image (or more commonly a soft area of a picture in this case) is over-saturation. When an image or image area is over-saturated, it loses detail and looks soft. This can often be corrected by reducing the saturation in-camera or in an image-editing program.

Sharpness: To satisfy a wide range of photographers, EOS Digital SLRs vary significantly in terms of range and default settings for sharpness, which is more correctly referred to as in-camera sharpening. Entry-level and advanced amateur models such as the EOS Digital Rebel, 10D and 20D use a 5-step sharpness scale from -2 to +2, with default settings typically at 0 (mid-scale) or +1. This is a noticeably higher level of in-camera sharpening than the default settings for EOS-1 class Digital SLRs, and may cause some concern for photographers who use both cameras. On the other hand, the default setting for sharpness level on EOS-1 class Digital SLRs is 0 on a scale from 0 to 5. This lack of in-camera sharpening was intentionally chosen by Canon to preserve as much

image detail as possible with in-camera JPEGs. (In-camera sharpness settings do not apply to RAW files because they can be overridden during conversion.) The default “no sharpening” setting allows maximum latitude for post-processing. In commercial printing for example, sharpening is best applied after the image is converted to CMYK. However, photographers who wish to reduce the need for post-processing of in-camera JPEGs should explore the use of higher in-camera sharpness settings.

Image-Making Concept for EOS Digital/Compact Digital Cameras



Please review the chart below to see how EOS-1D Mark II sharpness settings should be selected to match the default sharpness settings for the original EOS-1D and EOS-1Ds. We will have further discussions on image sharpening in the Post-Processing section of this document. For now, as mentioned previously, please note that your choice of in-camera sharpness settings can make a big difference in the appearance of your images, especially if you shoot in-camera JPEGs.

Desired Effect with 1D Mark II	Sharpness	Contrast	Color Matrix
Same sharpness as EOS-1D/1Ds	1	0	1-Standard
Sharp & Crisp Image	5	+2	1-Standard
Sharp, Crisp & Vivid Image	5	+2	3-High-Sat.

It should be understood that even the Level 5 setting for in-camera sharpening might not be strong enough for some applications. In those cases, it’s usually better to leave

the in-camera setting at Level 0 and apply sharpening during post-processing in a computer. [See Unsharp Mask](#).

Contrast & Saturation: With EOS-1 class digital SLRs, Contrast and Saturation can be adjusted on a 5 step scale from -2 to +2, with the default setting at 0 (mid-scale). Although neither of these settings directly affects the sharpness of an image, they can very significantly affect its apparent sharpness and overall appearance. The camera's default settings are usually satisfactory for most shots, but higher or lower settings may be preferable according to differences in personal taste, subject matter and lighting conditions.

Color Tone: This is another setting that does not directly affect sharpness, but the color tone setting can significantly affect the appearance of your digital images, especially if they contain skin tones. Lower settings produce reddish tones, while higher settings produce yellowish tones.

IV. SHARPNESS EVALUATION

Reviewing Images on the Camera's LCD Monitor

The first step in evaluating image quality for most EOS Digital SLR users is checking the LCD monitor during Review or Playback. The Mark II cameras are equipped with a zoom function that magnifies captured images up to 10x with a scrolling function to examine specific details. It's important to understand that the image used for reviewing purposes is actually a small JPEG (approximately 1,536 x 1,024 pixels) that's embedded into the file specifically for this purpose. This method drastically speeds up the review process compared to reading the full resolution file. The trade-off is that the level of detail is limited. There's enough data in the embedded JPEG to see (for instance) whether a subject's eyes were open or closed, or to get a rough idea of focusing accuracy, but not enough to read extremely fine detail. In other words, it's not possible to determine the actual sharpness of the image by looking at the camera's LCD monitor only. The next step towards evaluating image quality is downloading your images to a personal computer to view or print.

Monitor Evaluation Vs. Printed Output

Most experts suggest that the best way to evaluate the quality of a digital image is to view it at 100% magnification on a high-quality monitor. When the objective is image editing, this is good advice. These same experts also point out that average human vision cannot resolve more than 300 ppi (pixels per inch) for printed output. Using these specifications, please review the following chart:

Camera Model	Max. Resolution	Image Dimensions @ 72 dpi (Screen resolution)	Image Dimensions @ 300 ppi (Printing resolution)
EOS-1D	4.1MP (2464 x 1648)	34.2 X 22.9 inches (2.8 x 1.9 ft.)	8.2 x 5.5 inches
EOS-1D Mark II	8.2MP (3504 x 2336)	48.7 x 32.4 inches (4.1 x 2.7 ft.)	11.7 x 7.8 inches
EOS-1Ds	11.1MP (4064 x 2704)	56.4 x 37.6 inches (4.7 x 3.1 ft.)	13.5 x 9.0 inches
EOS-1Ds Mark II	16.7MP (4992 x 3328)	69.3 x 46.2 inches (5.8 x 3.9 ft.)	16.6 x 11.1 inches

Clearly, there is a tremendous difference between image dimensions on screen at 100% magnification and image dimensions at 300 ppi. EOS-1 class digital SLRs produce images so large that viewing them at 100% magnification is like viewing a poster-sized print. Also, keep in mind that most people view their monitors at much closer range than the normal viewing distances for prints. Under these conditions, the image is

bound to look softer than it would at greater viewing distances or lower magnification. Therefore, if printed output, especially at 8.5" x 11" or less, is the final objective, it's best not to rely completely on monitors to judge image quality. To prove this point, we encourage you to compare your printed images to the on-screen versions.

- Motion Blur** When high-resolution images are enlarged to 100% magnification on screen, image defects of any kind are accentuated. One such defect that is often mistaken for inaccurate focusing when viewed at smaller magnifications is motion blur. This can be caused by subject movement and/or camera movement, and is especially likely to occur at relatively slow shutter speeds. Remedies include shooting with a tripod to eliminate camera movement, using an Image Stabilizer lens during hand-held photography to minimize the effects of camera movement, and using either high shutter speeds or electronic flash to freeze subject movement. Secondary "ghost" images in flash photos can be minimized or eliminated by using faster sync speeds and/or lower ISO speeds or smaller apertures to reduce the effect of ambient light.
- Camera or Subject Movement After Focus Lock** The closer the subject, the more critical accurate focusing becomes. One potential problem to avoid is camera or subject movement after focus lock. This can happen more easily than one might think, especially during hand-held photography when the camera is set for One-Shot AF. Even slight camera movement or subject movement after focus lock can result in soft images, particularly when shooting at wide apertures with narrow depth of field.
- Diffraction** Diffraction is an optical phenomenon in which light waves pass around the edges of an object and enter the shadowed area of that object[†]. In photography, diffraction flare often occurs when images are shot at small apertures with short focal length lenses. The visual effect is a softening of fine detail that cannot be corrected in post-processing. If you are concerned about this optical phenomenon, we recommend avoiding apertures smaller than f/16 with wide-angle lenses and wide-angle zooms.

[†] EF Lens Work III

V. SHARPENING METHODS IN POST-PROCESSING

Adobe Photoshop's Unsharp Mask Filter

If little or no in-camera sharpening has been applied prior to viewing an EOS-1 class Digital SLR image at 100% magnification, especially with the EOS-1D Mark II, most photographers will agree that the image looks soft, even if it has been properly focused and exposed. This is mostly due to the detail-softening effect of the camera's anti-aliasing (AA) filter, which is permanently mounted in front of the image sensor. The AA filter plays an important role in reducing or eliminating false colors and moiré, but the trade-off is that images must be sharpened either in the camera or in the computer prior to final usage.

There are dozens of sharpening techniques, but the Unsharp Mask filter in Adobe® Photoshop® is one of the best-known methods. Some photographers prefer to sharpen only once prior to printing. Others apply Unsharp Mask twice: once to eliminate the softening effect of the camera's AA filter prior to editing for contrast and color balance, and again to compensate for the softening effects of various output methods prior to printing.

Also, many skilled photographers don't sharpen the entire image in post-processing. Rather, they apply sharpness only to appropriate areas. For example, they might sharpen the foreground in a landscape photograph and not sharpen the sky. This selective sharpening technique is easily accomplished with layers or masks.

Unsharp Mask offers 3 settings: Amount, Radius and Threshold. Radius and Threshold determine which pixels and which areas around them are affected by the Amount adjustment. As Adobe says, "The effects of the Unsharp Mask filter are more pronounced on-screen than in high-resolution output. If your final destination is print, experiment to determine which settings work best for your image." The difference is attributed to the screen's resolution being different from the printer's resolution.

If you haven't worked with Unsharp Mask, try the following settings as a very rough guideline for high quality inkjet printed output at A4 or Letter size:

Amount: 300%
Radius: 0.3 pixels
Threshold: 0 pixels

You'll find that small adjustments to Radius and Threshold have a much stronger effect than small adjustments to Amount. Also, sharpness preferences vary according to subject matter (human subjects often look better with less sharpening, whereas

finely-detailed landscapes and architecture, etc. usually need more sharpening) and noise levels. (Sharpening accentuates noise, especially in shadow areas.) There are many other Unsharp Mask “tricks” such as applying sharpening in the Lightness channel in the LAB mode in Photoshop rather than the entire image in RGB.

There is no “right answer” for sharpening. What looks great for one viewer may seem excessive to another, and vice versa. Optimum sharpening levels also depend on output size, viewing distance and printing methods. For instance, many professional wedding photo labs request their customers to send in unsharpened files so that the lab can apply their own unique custom sharpening algorithms, which often vary according to print size.

In fact, generally speaking it’s a good idea to save an unsharpened version of each image file so that you’re always working from a “clean slate” so to speak, should there ever be a need or desire to apply a different sharpening technique at a later date or for another application. (This is one of the best reasons for shooting RAW files.) Remember that sharpening an image is like using permanent ink: it’s easy to apply, but difficult if not impossible to remove.

3rd Party Sharpening Software

The necessity of sharpening digital images prior to printed output has resulted in a wide variety of 3rd-party sharpening filters and plug-ins. Some of these, such as nik multimedia’s Sharpener Pro, operate within Photoshop and other plug-in compatible programs. Others, such as Digital Domain’s popular Qimage software are standalone applications. Although Canon does not officially endorse 3rd-party products, we encourage users to explore the available options in image sharpening software. Here is a partial list of current sharpening filters and applications:

Vendor: nik multimedia, inc.

Software Title: Sharpener Pro

Web Page: <http://www.nikmultimedia.com/sharpenerpro/usa/entry.php>

Vendor: Digital Domain, Inc.

Software Title: Qimage

Web Page: <http://www.ddisoftware.com/qimage/>

Vendor: Fred Miranda

Software Title: Intellisharpen II

Web Page: <http://www.fredmiranda.com/software/>

Vendor: Jonathan Wienke

Software Title: Sharpening Actions

Web Page: <http://visual-vacations.com/Photography/SharpeningActions.htm>

Vendor: Noel Carboni
Software Title: dSLR Fractal Sharpening
Web Page: http://actions.home.att.net/dSLR_Fractal_Sharp.html

Vendor: www.thepluginsite.com
Software Title: FocalBlade
Web Page: <http://www.thepluginsite.com/products/photowiz/focalblade/>

RAW Converters

There are almost as many RAW converters on the market as there are 3rd-party sharpening filters. Some RAW converters provide sharpening adjustments prior to conversion. Here's a partial list of popular RAW converters that work with EOS RAW files:

Vendor: Canon
Software Title: Digital Photo Professional 1.5
Web Page: TBD (Supplied with all EOS-1Ds Mark II, EOS-1D Mark II and EOS 20D as of November, 2004)

Vendor: Canon
Software Title: EOS Viewer Utility
Web Page: <http://consumer.usa.canon.com/ir/controller?act=DownloadIndexAct>

Vendor: Adobe
Software Title: Camera Raw
Web Page: <http://www.adobe.com/products/photoshop/cameraraw.html>

Vendor: Bibble Labs
Software Title: Bibble
Web Page: <http://www.bibblelabs.com/>

Vendor: Breeze Systems
Software Title: BreezeBrowser
Web Page: <http://www.breezesys.com/BreezeBrowser/index.htm>

Vendor: PhaseOne
Software Title: C1 Pro
Web Page: <http://www.phaseone.com/>

Of course, RAW converters can have a dramatic effect on many aspects of image quality other than sharpening, such as highlight/shadow transitions (tone curves), color rendition, noise levels, and so forth. RAW converters also vary significantly in conversion speed, color management capabilities and other workflow-related issues. We encourage you to explore the various offerings to find your own favorites. Canon offers a detailed, animated Web tutorial on Digital Photo Professional (DPP) from well-known photographer and Photoshop expert Eddie Tapp here: <http://www.photoworkshop.com/canon/dpp/index.html>

VI. EQUIPMENT CALIBRATION ISSUES

AF System Calibration If the camera and lens are being operated correctly, but images remain consistently out of focus, there is always the possibility that the camera or lens is not performing according to factory specifications. EOS cameras and EF lenses are precision instruments, and as such they require precision adjustments to perform at peak efficiency. Although Canon makes every effort to calibrate the AF systems of EOS cameras in the manufacturing process, a small percentage of cameras require calibration adjustments at the Factory Service Center (FSC) after sale.

AF system calibration at the FSC involves a series of tests to determine the positioning accuracy of mechanical components such as the image sensor and reflex mirror assemblies. Once these potential problem issues have been eliminated, test images are taken using a “tool lens” with known performance characteristics. The testing method enables technicians to ensure that the camera is performing well within tolerances for AF accuracy. Once this has been done with the tool lens, it becomes possible to check the performance of other lenses the customer may have.

Lens Calibration Because each autofocus lens contains its own microcomputer and many other internal devices such as focusing motors and diaphragm actuators, lenses occasionally require calibration. If a focusing error is detected, the circuitry of the lens itself can be adjusted to ensure that it is operating according to design specs. Calibrating a lens does not compromise its performance with other camera bodies because the calibration standards for the lens are independent from the calibration standards for the body.

Please keep in mind that we do not recommend sending equipment to the Factory Service Center unless you are sure that the source of your image quality problems is not one of the issues we have already discussed in this document.

Testing Your Own Cameras & Lenses Although photographers in the field cannot duplicate the testing capabilities of a Canon Factory Service Center, it is certainly possible to test cameras and lenses at home or in a studio to check their performance. The following procedure may help you determine whether your camera equipment is in need of calibration.

1. Perform your focusing test at a reasonable light level (office lighting or brighter) to ensure optimum results.
2. Place the camera on a sturdy tripod and use a remote switch when firing the shutter. For maximum quality, consider the use of mirror lock. (C.Fn 12 on EOS-1 class Digital

- SLRs.) If you are using an IS Lens, turn off the Image Stabilizer.
3. Select a focusing target with adequate detail from center to edge. A newspaper page is a good choice.
 4. Make sure that the target is totally flat and as parallel as possible to the camera.
 5. Set the camera to One-Shot AF and manually select the center focusing point.
 6. Compose the picture so that the test target fills the frame from edge to edge.
 7. For each of your lenses, make one exposure at the maximum aperture of the lens and another at f/8, varying the shutter speed if necessary to adjust the exposure level as indicated by the histogram on the camera's LCD monitor.

Evaluation Method A: Use EOS Capture or RemoteCapture software to analyze your images as soon as they have been transferred to your computer. RemoteCapture has a 100% magnification viewing option. (If you are using EOS Capture, you can use EOS Viewer Utility or Digital Photo Professional to enlarge the images.)

Evaluation Method B: Open the images in your computer and make two copies of them: one "as is" and another with a liberal amount of unsharp mask applied. Here are some recommended settings: Amount, 300%; Radius, 0.3 pixels; Threshold 0 pixels.

Make letter-size prints on a high-quality inkjet printer using photo paper and photo ink. Compare the results. If the camera has a consistent focusing problem with several different lenses, then it's reasonable to assume the camera needs an adjustment. If you are getting sharp results from most lenses but not all, then it's reasonable to assume that the lens in question may need an adjustment.

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