

Canon USM Lens vs STM Lens: Things You Must Know

Introduction

If you want to take a prize-winning photograph you have to get the exposure right, but it's even more important to have crisp and clear images. If you are using Canon equipment, to get the sharpest results it's handy to know about the way their lenses work, so you can make an informed decision when it's time to purchase one. There are a few different types of autofocus systems that you should be aware of, and we'll explain each one so you can get a lens that is suitable for the type of photography that you like to do. But first, let's look at how these lenses originated and then evolved into today's systems.

History of Canon Focusing Systems

Everyone has heard of the Canon EOS, but not many know what those letters stand for. The abbreviation EOS represents 'Electro-Optical System' which is an autofocus design for single-lens reflex cameras. EOS was produced by Canon in 1987 and it is still in use today in Canon's DSLRs and mirrorless cameras. This innovation was based on having the focusing motors within the lens itself. Previous to this, Canon had the focusing motor in the body of the camera and it was mechanically connected to the lens. To put this autofocus system into their lenses, Canon had to drop the FD lens mount for manual focus cameras and replace it with an innovative, bayonet-style EF lens mount which had no mechanical linkages between the lens and the body of the camera. One of the reasons for changing the mount was so they could establish an electronic interface between the lens and the body, which gave them a fully compatible lens system in readiness for the digital revolution that was to come. The larger diameter of the EF mount enabled Canon to position the lens further from the film plane, which made it easier for them to design its new group of lenses. And a larger lens mount gave more area for the electrical contacts that form the basis of communication between the body of the camera and the autofocus motor within the lens.

The code 'EF' stands for 'Electro Focus' and it represented the use of fully-electronic focusing technology. Linking the camera with the lens via electrical impulses meant that Canon could produce a high-speed and high-precision autofocus system. The radical development of housing Canon's autofocus system within its lenses was advantageous because the autofocus motor could be tailored to the requirements of each lens. A larger telephoto lens could have a more appropriate motor, and a smaller lens could use a more compact motor to drive it. Controlling the lens via electrical impulses gave the opportunity to manipulate the aperture through these electrical contacts too. Having the aperture operating through electrical links enabled smoother video recording, which was a highly desirable feature for many amateur and professional consumers. Although Canon didn't invent the autofocus system, its EF lens mount improved it and brought greater versatility and reliability.

Photographers embraced this revolutionary autofocus system, with Canon capturing a huge chunk of the market while the other brands struggled to catch up. The three main types of focusing motor technologies still used by Canon are: the conventional DC motor, USM, and STM. Let's look at these variations to show you the difference between them.

Canon System Types

DC – Direct Drive Motor

If you can't see the letters 'USM' or 'STM' printed on the front of your Canon lens, then it's probably driven by a direct drive motor. This style of traditional, magnet motor has quick autofocus abilities, but it's not as smooth and quiet as ones using STM or USM technology. The letters 'DC' stand for 'Direct Connect' and you'll usually find this system in older Canon lenses that incorporate a geared motor. This form of autofocus motor drives the movement of the glass elements inside the lens, which is how it changes what is in focus.

Although this system is cheaper than the others, it has three main disadvantages...

- 1) They are slower to focus than other systems, which is annoying when you are trying to set the focus on people doing sporting activities, especially when they are moving closer to the camera and then turning and going further away.
- 2) They are noisier than the upgraded USM lenses. This rattling sound may only bother you (and those close to you) when you are taking still shots in quiet environments such as weddings and funerals, but when you switch to movie mode you'll be disappointed to discover how much jarring gear noise is captured by the inbuilt microphone.
- 3) They do not allow Full Time Manual (FTM) focusing. Full Time Manual focusing has been an appealing feature for Canon users for decades because it allows you to fine-tune the focus point after the autofocus has done its job. If you try to manually correct the focus when using a DC lens, you'll be grinding gears by forcing the focus motor, so don't do it! Save up a few more dollars and buy a lens with USM engineering instead.

USM – Ultrasonic Motor

When Canon first tried to create an autofocus system for their cameras, they incorporated the focusing technology in the body of the camera, but this wasn't as successful as their competitor's efforts. Their next idea was to build a compact focusing motor inside a lens. This unconventional idea has now become common practice. The first development of this type of autofocus used an ultrasonic motor, so you'll find the letters 'USM' printed on the side of these lenses. The lens is operated through the conversion of ultrasonic vibrations that turn the focus ring. There are three distinct differences between the USM system and the use of a DC motor...

- 1) The USM autofocus is much faster. This is ideal for sport photography where subjects are always on the move and the action needs to be tracked and locked within milliseconds. Wildlife photography also benefits from the extra speed of the USM lens, as you want to be able to capture images of skittish birds and animals before they take off.
- 2) USM lenses are quiet compared to a DC lens (especially in manual focus mode).
- 3) Full Time Manual (FTM) focusing is enabled on USM, but not on DC direct drive motor lenses. When using USM lenses, you can half-press the shutter to activate the autofocus and then you can also manually turn the focus ring to select the area you want to be the sharpest point of the image. The lens is mechanically coupled from the focus ring to the focusing mechanism inside the lens, but it has a clutch that slips the gears to allow you to adjust focus. With USM lenses you don't have to flick the switch to turn off the autofocus in order to adjust the focus. If you are doing macro, wildlife, or wedding photography, it's handy to be able to tweak the focus to the exact area you desire. It is also useful in dark conditions when the autofocus can take too long to

find your intended subject. DC lenses do not allow FTM. To avoid damaging the gears you have to flip the switch on the lens barrel from AF to MF before manually focusing.

These points show that USM lenses have many major advantages over DC lenses, but on the negative side, USM lenses sometimes have jerking movements when searching for focus points in low light. And when photographing scenes that lack contrast, you'll find the AF motor starting and stopping and starting again as it hunts for focus. USM lenses have a more solid and robust build than the DC options, but this means they cost a bit more too. Canon claims that USM lenses are 'near silent', and this is true of the Nano USM lens, otherwise when you are in video mode the microphone on the camera will pick up shuddering vibes on the other USM lenses as they change between focus points.

Different Types of Ultrasonic Motors

The evolution of USM lenses had three distinct levels of development. The first was called the Ring-Type motor, followed by the Micro USM, and now we have Nano USM, which is the top of the range so far. Here's a description of each type of lens.

Ring-Type USM

The Ring-Type ultrasonic lens contains two metal rings; one of them is connected to the focusing system and the other to the barrel. When one of them vibrates at ultrasonic level, the other rotates to complete the focus. Because there isn't a gear system, the autofocus is very fast. Ring-Type USM lenses are also known to be one of the most accurate systems, and when shooting still photos they are also relatively silent when they hunt for focus.

Micro USM

Camera consumers are a fickle bunch. They want the latest lens, but many don't like paying a premium price. USM lenses have huge advantages over DC lenses, but they come with extra weight, and a higher price. Canon decided to counter those issues by creating the Micro USM lens which still incorporated ultrasonic frequencies, but they also used gears like the DC lenses. This meant the lens was lighter and could be manufactured more cheaply to suit the budget-conscious market. However, as with the DC lens, when using most Micro USM lenses you are unable to do full time manual focusing. And you'll notice a distinct whirring sound while it tries to find focus. Out of the USM range this one is only going to appeal to those who are looking for a basic lens at a reasonable price. Professional photographers should stay away from this option.

Nano USM

Discerning camera owners were excited by the release of the Nano USM lens. Canon had managed to blend the Ring-Type USM with a rack assembly supported by guide bars. It was similar to lead-screw technology where cam gears were unnecessary, so they ended up with a near-silent and smooth autofocus that was blindingly fast. Through this new development they overcame the slight noisiness that was previously noticed while capturing video, and they improved the image stabilization to reduce camera shake during low light, hand-held situations. It is the ideal lens for those who want to use their cameras for still photography and for creating movies too. In movie mode this lens has natural-looking transitions between points of focus. And best of all, when your subject is

being tracked, the inbuilt microphone won't pick up much sound from within this USM lens because the focusing elements effortlessly glide along inside the barrel. The Nano ultrasonic motor is smaller than your fingertip, but it contains a microchip-shaped slider that uses linear movement to shift the focusing lenses around. Because the Nano USM's ultrasonic vibrations don't have to be changed into rotational movement, it is more responsive to focusing signals. In other words its fusion of ultrasonic principles with mechanical technology produces speed and smooth focusing with hardly any sound.

Pros and Cons of USM

Advantages

- 1) Amateur and professional photographers love Canon's USM autofocus system because it's fast and reliable in its accuracy. As you switch from one subject to another, they rapidly snap into focus regardless of how far apart they are. Even when tracking a fast moving object coming towards you, the USM lens keeps it in focus all the way.
- 2) The Ring-Type USM is reasonably quiet when taking still shots. The Nano USM is virtually silent when doing still shots and movies.
- 3) The ability to manually focus while using the autofocus mode of the Ring-Type and Nano lens is extremely beneficial to serious photographers who want to go beyond the spot-focus option. Animal photographers and portrait specialists love both of these lenses for the ability to use FTM to make sure the eyes are the sharpest part of the image, regardless of which part of the subject's body is closest to the camera.
- 4) There is substantially better build-quality on the Ring-Type USM and Nano USM lenses compared to other models.
- 5) The Canon Ring-Type USM and Nano USM are professional grade lenses. USM autofocus is used in Canon's top-of-the-line L-Series lenses.
- 6) The only good thing about the Micro USM is the lower price and lighter weight.

Disadvantages

- 1) There are higher price tags attached to the Ring-Type USM and Nano USM lenses.
- 2) If you want to make movies using the Ring-Type USM or Micro USM lens, the jerkiness and noise generated by the autofocus as the glass elements move around will be a distraction.
- 3) The Ring-Type USM and Nano USM lenses are quite heavy compared to standard DC lenses.

STM – Stepping Motor

The negative feedback that Canon had from videographers about the lens noise and lack of smoothness from most USM lenses forced this manufacturer to consider an alternative. They soon came up with a new type of lens called 'STM'. This new piece of equipment used a Stepper Motor which is an electrical motor that rotates in steps. This type of motor doesn't use contact brushes, making it reliable and relatively inexpensive. Canon designed two versions for the marketplace, with each having some advantages and disadvantages.

The Different Types of STM Lenses

Lead-Screw STM Lens

The Lead-Screw STM lens was manufactured with the videographer in mind. Its motor runs along a lead pipe which deadens sound as it moves along the focus range. The Lead-Screw design of this lens is low-maintenance and cheap to manufacture, so the price tag is affordable for those who want to dabble in video production through a reliable and reasonably priced product. This all sounds ideal, but there are a couple of things to watch out for...

- 1) When using autofocus this system takes a little longer to latch onto its subject.
- 2) It's bigger and heavier than its little brother, the Gear-Type STM lens.

Gear-Type STM Lens

If you want a more compact STM lens then go for this one which uses a helical Gear-Type Stepper Motor to drive the autofocus. Being smaller means it's lighter, but using gears to drive the focus means you go back to the same noise problems discovered in DC motors and the Micro USM. When this geared motor is rotating the focus ring, it makes a low-level lens noise which is somewhat noticeable during the autofocus of still shots, and it's definitely evident during videography.

Pros and Cons of STM

Advantages

- 1) The price of Canon's STM lenses is much lower than Canon's USM lenses.
- 2) When using the inbuilt microphone of the camera, a Lead-Screw STM lens will focus more quietly than most USM lenses, allowing you to record the intended sounds, rather than the inner workings of the camera.
- 3) It's easy to notice the improved level of smoothness of the focusing system of the Lead-Screw STM lens compared to any USM lens. All you'll hear is a slight electronic hum of the motor, not the movement of the inner workings of the lens sliding around.

Disadvantages

- 1) STM lenses take a little longer to focus than USM lenses.
- 2) The build quality of the barrel and the grade of the glass is not as good on STM lenses. If you drop your lens the plastic barrel could crack, and the glass will probably break.
- 3) STM lenses are not weather-sealed.
- 4) You can't use Full Time Manual adjustments on STM lenses when autofocus is engaged.
- 5) If you switch to manual focusing, the focus-by-wire mechanism makes a slight amount of noise during focus pulls — and you'll notice a minor lag because you are only indirectly moving the focusing element when you twist the focus ring.

Conclusion of USM vs STM

In an ideal world the perfect lens would be a combination of both the USM and the STM lenses, but since you can't have that it's up to you to consider whether photography or videography is your main objective when using your camera. If you are mainly into still photography then the Nano USM lens has many advantages including a professional

grade build, an extremely fast focus speed, and weather sealing. They are an ideal choice for street photography and for doing any form of action photography. For wildlife photographers, using USM lenses has the benefit of being able to switch between subjects ultra-fast, even when they are on the move. And the Full Time Manual adjustments to the focus ring to ensure accurate targeting of the focus point is essential for professional photographers in all fields of expertise. The Nano USM lens is about as quiet as the Lead-Screw STM lens, but the other USM lenses are even noisier than the gear driven STM lenses, and they are more expensive. If you are a hobbyist photographer with a bit of cash to splash, and if you don't mind the whirring of the autofocus as it changes its target point, take a good look at the Ring-Type USM. If you are a professional photographer then the Nano USM lens is going to be ideal for your camera bag because of its speedy focusing abilities in still images and video. Since the rattling and whirring of the Ring-Type USM lens and the Micro USM lens during videography is the main area of negative feedback about these units, remember that this noisiness can be minimized through the use of an external microphone, so don't let those sounds discourage you from buying either of those Canon lenses.

Overall though, Canon's STM lenses are the superior option for making any type of videos. They have a silent focus and they generally cost less than USM lenses. Because they don't have contact brushes in the motor, they should work for an extremely long time without any issues. There's definitely less jarring of the image as it shifts from one focus subject to the next. On the negative side, the shell of the lens isn't built as solidly as USM lenses, and they take a bit longer to find their point of focus. But this slower shift of focus between one subject to another is what makes for a smoother transition, so it's difficult to see this as a problem, or an advantage...perhaps it's a bit of each! What you can say for sure is that since STM lenses were built specifically for video, they should be the top choice for serious videographers who want a silky smooth, whisper-quiet change of focus.