

Choosing a Canon Macro Lens by Working Distance vs. Price

By Jack Rabin. Last Edited June 26, 2006

All macro lenses are brutally sharp. Little is gained comparing lens sharpness between brands and focal lengths. Canon, Nikon, Minolta, Olympus, Pentax, Sigma, Tamron, and Tokina macro lenses are all sharp. An alternative way to choose macro lenses is comparing their **subject working distance (WD)** when at close focus 1:1 magnification versus their price. Then determine if you prefer (can afford) internal focus floating element optical design macro lenses. Macro lenses focus continuously from macro through infinity (not the Canon MP-E65). While all macro lenses are optimized for close focus, sharpness varies at normal subject distances. This article presents close focus WD.

What is Working Distance? WD is the distance from **lens front to subject** (without hood) when at closest focus, usually 1:1 life size reproduction. Lens manufacturers publish "minimum focus distance," the distance from the sensor/film plane to the subject. This is less useful than knowing WD.

Calculate Working Distance. $WD = \text{published minimum focus distance} - \text{lens length} - \text{distance from lens mount flange to sensor/film plane}$ (approx. 4.4 cm for Canon EOS system). WD is a big limiting use factor (in addition to light loss). Get as much WD as you can afford.

1x Life Size Working Distances (WD) vs. Lens Prices

60mm Canon macro EF-S USM	= 10cm WD	@ \$400
100mm Canon macro EF USM	= 15cm WD	@ \$470
150mm Sigma macro HSM	= 20cm WD	@ \$580
180mm Canon EF USM	= 25cm WD	@ \$1,260
180mm Tamron macro	= 26cm WD	@ \$690

Other lenses

50mm Canon f/2.5 1:2 Compact macro	@200
65mm Canon MP-E65 f/2.8 1-5x Macro Photo	@830
300mm Canon f/4L IS, +2 Diopter 500D & 1.4X TC	@\$1,500

60mm macro EF-S USM = 10cm WD. Unless you need 50-60mm, longer macro lenses are better WD values. The 60mm is limited to EF-S mount cameras. 20D/30D EF-S bodies have coarse focus screens "snapping" in or out of the point of focus during manual focus. Sometimes 60mm has insufficient WD or the photographer's body casts shadows on the subject. Users respecting Nikon 60mm f/2.8 micro Nikkor waited years for Canon to make an equal. It happens to be EF-S. Carry the Canon 60mm macro when: **a)** Using EF-S mount body. **b)** Portability and maneuverability for fieldwork or travel without a tripod are necessary. Handhold

60mm with less camera shake at slower shutter speeds than longer lenses. Carried with zooms in a vacation kit (e.g., 17-40mm and 70-200mm), a 60mm macro becomes the lower (if not quite low) light lens as well as macro in a three-lens kit. Hood must be purchased extra. Other features include: **c)** Impressive resolution, contrast & color. Cool natural tone, vivid reds and greens remind of Kodachrome 64 transparency film. **d)** Works as a studio portrait or product lens. **e)** Canon's best lens coatings, circular aperture, and best Canon Ring USM focus **f)** Only Canon USM macro where filter removal is not necessary when attaching Canon 14EX or 24EX macro flash. The Canon 50mm Compact macro f/2.5 shares 52mm thread feature.

100mm macro EF USM = 15cm WD. You pay about \$70 more to add 5cm WD from Canon 60 to 100mm macro. 5cm is a 50% WD distance increase. European buyers may not have a cost differential. 90-105mm is considered most flexible focal length macro for wide variety of needs. With internal focus floating internal elements, the Canon EF 100mm USM has a shorter focal length at 1:1 reproduction, likely 80mm+/-, maintaining a good field of view at 15cm WD. This is a great flexible lens. Alternate use as a medium telephoto or portrait lens, though sometimes almost too honest; revealing facial skin blemishes. Hood must be purchased extra. Better Canon Ring USM focus motor. Everyone respects this lens.

150mm Sigma macro HSM = 20cm WD. Pay additional \$110 for another 5cm WD increase from the Canon 100mm. The Sigma 150mm comes with a hood, tripod collar, HSM auto focus with full-time manual override (I manually focus much of the time), making it an excellent lens, if focal length fits needs. It is a Sigma lens contributing to photography performance - not another a "me-too" price-point product. There is nothing wrong with this lens. It has internal focus so lens barrel length does not change during focus, unlike the Sigma 105mm. The Sigma 150mm takes beautiful photos and promises to be popular. The color rendition tends to warmer yellow tones. The Sigma 150mm only stops down to f/22. Most users never have enough light to stop down that far, and diffraction limits sharpness even if light permits stopping down to f/22+. Thus, for most users this is a non-issue. But some users of Canon 180mm macro do stop down beyond f/22, and Sigma lens does not. Sigma4Less.com sells it reasonable. A Canon 72mm Macro Lite thread adaptor is needed to connect the Canon 14 EX or 24 EX macro flash.

180mm macro f/3.5L EF USM = 25cm WD. Pay \$680 more for the next (last) 5cm WD gained from the Sigma 150mm. Good for bugs and snakes. The last macro lens you'll ever buy (unless you need greater reproduction from the Canon MP-E65mm 1-5x). It is a "L"uxury lens. Some features include: **a)** Canon's best lens coatings. **b)** Unlike most macro lenses losing two f/stops of exposure when close focused, the 180mm L only loses 1 1/3 stops. Thus, it's f/3.5 aperture is not a disadvantage compared to f/2.8 lenses. It's big and long and prefers to be used tripod mounted, except when butterfly hunting. **c)** Maintains optical sharpness and low diffraction

stopped down beyond f/22. **d)** Ultimate WD. The longer focal length makes it easier to compose shots. Isolate subjects, eliminate clutter, and get the lens plane position parallel to where you want the maximum depth of field on a subject. **e)** Works well with the Canon 1.4x teleconverter, for 140% life size at the lens' close focus. Thus, back away from 25cm close focus and still obtain life size reproduction. With the 1.4x TC manual focus is required below 80cm. **f)** A Canon 72mm Macro Lite thread adaptor is needed to connect the Canon 14 EX or 24 EX macro flash.

180mm Tamron = 26cm WD. Tamron is the longest WD versus price value winner, but I did not use it because a non-standard lens front filter adjuster may prevent using the MT 24-EX Macro Flash.

Other Lenses

Internal focus. The 90-100-105mm price-point alternative lens offerings from Tamron, Sigma, and Tokina are satisfactorily sharp. Their lens barrels change in length—extending—during focus. Decide for yourself if barrel movement affects your photography. If you're serious about field macro, a macro lens where the lens barrel length does not change during focus is a \$100 convenience. Lens barrel extension during focus doesn't affect image quality, but affects focusing on insects or critters exhibiting evasive behavior when detecting nearby shadows.

Manual Stop-down and Manual Focus Lenses. Some users buy Nikon-EOS, Olympus OM-EOS, Leica-EOS mount adaptors and use these lenses as manual focus manual stop-down macro lenses on their Canon cameras. Others use normal lenses with reversing rings. These are esoteric fun, sharp, good in a studio, sometimes expensive, and not convenient for fieldwork.

The **Canon 50mm Compact macro f/2.5** has a fast maximum aperture. It is a rugged and easy to carry lens highly resistant to flare and moderately priced, and available used for \$200. If you do not have an EF-S mount body, this is what's available in EF mount in normal focal length. While only achieving 1/2 life size, it is regarded for uses such as distortion free product photography and copy work. This lens is easy to carry in a pocket walking about. The color rendition is not as good as the EF-S 60mm macro. The lens barrel extends during focusing.

The **Canon MP – E65 f/2.8 1-5x Macro Photo** is a specialized macro lens beginning at 1x life size reproduction and extending to 5x reproduction. It is designed, and succeeds, as an easier to use and operate alternative to bellows. Since it does not focus to infinity, it is not considered here, and can be evaluated at many other web information sites.

Canon EF 300mm f/4L IS (or telephoto zoom lenses) for dual use field close-ups.

There are a number of reasons why a Canon 300mm f/4L IS (or Canon 100-300, 70-300 IS or 70-200) lenses with a 1.4x TC and 500D +2 diopter work for field close-ups. The Canon 180mm f/3.5L macro is a stunning lens. But it prefers a tripod. The IS benefits hand holding. **a)** If you are “never close enough,” like giving subjects space, like using a 300mm for sports, family photos, landscapes, this combination works because many times in the field 1x life size is not needed. **b)** The 300mm f/4L has 0.25x magnification, good for a telephoto or tele zoom. Other lenses like Canon 200 f/2.8L, the 135mm f/2L, etc, have 0.15 to 0.20x magnification. This affects gain when TC and diopter are added. The longer the focal length and greater the lens magnification, the more the subject magnification increases when using a diopter. **c)** There is no light loss using Canon 500D +2 Diopter close-up filter, unlike using extension tubes. Focusing is easier. The 1.4x TC can be used or not, varying the magnification. Though you lose 1/stop with the TC, to f/5.6, most Canon bodies will still auto focus at f/5.6. **d)** The 300mm f/4L IS is a wonderful lens for sports and larger wildlife. With the 1.4x TC you have a f/5.6 "almost" bird lens. The only downside is if 300mm is too long for your non-macro uses, like kids soccer on a small field.

Close-up at Less than Life Size. Macro is life size, 1:1 reproduction, 1x magnification or greater. There is loads of fun close-up photography at less than life size, 0.25x to 0.70x (butterfly and dragonfly hunting) you can do with extension tubes, close-up filters (diopters), or close focusing zoom lenses. A modest Canon 100mm-300mm zoom with a Canon 500D (\$140) +2 diopter makes a good butterfly hunter, providing about 0.4-0.7x life size reproduction, depending on lens focal length and maximum magnification specification.

Wide Angle and Extension Tube Close-ups or Tilt-Shift lenses

Using a wide angle lens with an extension tube enables “thing in its environment” close-ups. These are useful and popular for environmental documentary photography, pulling viewers into the frame, and sometimes stunning. Lenses include Canon 17-40mm f/4L, 16-35 f/2.8L, Sigma 20mm f/1.8, Sigma 15mm f/2.8 Fisheye, Sigma 17-70 f/2.8-4.5, Canon Tilt-Shift lenses, etc.

Macro Lens Focal Length vs. Field-of-View & Depth-of-Field vs. Background Blur

When selecting a macro lens for use at macro distances, ignore the impact of the APS-C sensor field-of-view crop factor (FOVC) on the effective lens focal length. Sensor FOVC is relevant at normal photography distances. Choose a macro lens for its handling and working distance. How focal length FOVC affects subject framing is more important for alternate normal photography uses of lenses.

It is a struggle to obtain sufficient DoF under macro conditions. Focal length is less important than framing angle on the subject. The common opinion is, given lenses of similar optical design, the shorter the focal length, the greater the DoF; the longer the focal length, the more distance is compressed behind the plane of focus

(less DoF). But this is too simplistic, and does not hold up under close focus distances with floating element macro lenses.

<http://www.vanwalree.com/optics/dof.html> is very good amateur read on the subject. Navigate to sections where macro DoF is considered. Author makes the case a telephoto macro lens for many applications offers three advantages over its more symmetrical competitors of shorter focal length: an increased working distance, an increased depth of field, and a narrower field of view that comes with a more (absolutely) blurred and less obtrusive background.

Light Loss

Camera lens f/stops are designed for infinity focus. As magnification increases [distances get closer] the actual aperture (effective f/stop) becomes darker. The classic formula was 2 f/stops light loss at close focus 1x reproduction. [There is less loss, 1 1/3 stops, with Canon 180mm internal floating element lens.]

The camera TTL meter automatically measures this light loss. What we experience is f/stop-shutter speed challenges at macro magnification. E.g., A scene set at f/8 that a camera meters for 1/200 as a normal exposure with a regular lens, is metered as 1/50 with a macro at close focus. We experience it as slower shutter speed or lower f/stop macro challenges, requiring tripod and flash use.

A few, Among Many, Sources of Beginner Macro Information

Tom Hicks 3-part beginners macro with dioptors and extension tubes.

<http://www.natureswildscapes.com/index.php?category=gallery/zzzArticles>

Steve Hoffman on macro flash, using Canon's MP-E65mm lens, and other topics.

<http://www.sphoto.com/techinfo/phototech.html>

A section of Nikonian's web on macro and close-up photography. Good explanation of reversing rings.

http://www.nikonians.org/html/resources/nikon_articles/other/close-up_macro/macro_0.html

A sight that explains DoF alternatives under macro reproduction.

<http://www.vanwalree.com/optics/dof.html>

The Photo.net Forum site has many pieces of information from Bob Atkins, particularly on general and Canon macro lens calculations.

<http://www.bobatkins.com/photography/eosfaq/closeup2.htm>

<http://www.bobatkins.com/photography/eosfaq/closeup.htm>

Phillip Greenspun macro introduction from "early days" of the web.

<http://www.photo.net/learn/macro/>

Explains diopter close-up filters, and also has other useful information.

http://www.rogercavanagh.com/helpinfo/18_500d-1.stm

Italian photographer has a good technical site on macro magnification, and a review of Nikon's macro and non-macro lenses.

<http://xoomer.virgilio.it/ripolini/>

Making a light tent softbox cheaply with PVC pipe.

http://www.pbase.com/otfchallenge/light_box