



How to Choose a Macro Lens

Ronald Ross, IACC Special Interest Group Chair

One of the main questions people ask when they want to start doing close-up photography is “what equipment do I need.” There are lots of options for getting “up close and personal” with your subject, including relatively inexpensive options such as close-up filters and extension tubes. They are a good way of trying close-up, but if you are going to get serious about it, you will probably want a dedicated “macro lens.” All of the major camera manufacturers and aftermarket companies make high quality macro lenses. (Caveat: Read lots of reviews of any lens you are thinking of buying).

Any serious macro lens will be a prime (single focal length). Some zoom lenses are sold as “macro” but in most cases are limited to 1:5 to 1:3 reproduction ratio. These won't really provide you with enough magnification, as you will want 1:1 or 1:2 reproduction ratio. Macro zooms also have other drawbacks for serious close-up work. They are OK if all you want is the occasional frame-filling flower, or if you are worried about weight for your travel kit.

There are two design features you should look for right away when considering a macro lens. For a start, a good macro lens will be made using **extra-low dispersion glass** to minimize chromatic aberration. The closer you focus, the worse this becomes. The lens design should also include a **flat field focal plane**. With this, the focal plane is truly parallel to the sensor. Most lenses produce a slight curve. It's hard to detect if you are shooting at longer distances (over ~40-50cm), but can become painfully obvious in close-ups.

These features mean that a serious macro lens will tend to be expensive compared to another prime of the same focal length and aperture. On the other hand, a good macro lens is usually very good for other uses. A few archaic designs don't actually focus to infinity, which limits their usefulness.

All of the other important features to look for in a macro lens have to deal with depth of field. Both technically and artistically, close-up photography is dominated by shallow depth of field. For practical purposes, depth is determined by four things: sensor size, aperture, focal length, and focal distance. The larger your sensor, the shallower your depth of field (all other things being equal). The larger your aperture (smaller the number), the less depth of field you have. The longer the focal length of your lens, the less depth of field you have. And, very importantly for close-up, the closer you get, the less depth of field you have. I can't quantify it here, as different combinations of lens, distance, aperture, and sensor will give you different results.

The problem of shallow depth of field leads to several features being desirable in a macro lens. The first of these is that the lens should have the ability to **stop down** as far as possible, to give you as much depth of field as possible when you need it (and you will). Most true macro lenses stop down to $f22$ or smaller (larger number=smaller hole). Many lenses, macro or otherwise, are thought to start to lose image quality at their smallest stops, but having $f32$ means you should be able to safely use $f16$ or $f22$. (Note: concern about lack of sharpness at small f-stops may be overblown – try it with your own equipment and see if you can detect a difference).

Because depth of field becomes shallower as you get closer, most macro lenses are less concerned with maximum aperture. Most macro photography is done on a tripod, so long shutter speeds are not a problem. At the same time, manufacturers do not want to make the lens useless for other forms of photography, or make the viewfinder too dark, so most macro lenses have maximum apertures from $f2$ to $f4$. Finally, on the subject of aperture, the lens should have **rounded aperture (diaphragm) blades**, or a large number of blades, to produce more pleasing rounded out of focus highlights (bokeh).



Shallow depth of field leads to another important feature of macro lenses: **manual focus**. A good macro lens will have a focus ring that is *less sensitive* than a normal prime or zoom lens. In other words, you have to turn it further to move the focal plane the same amount. This gives you more precise control. In most photography, some error in focus is acceptable; even wide open the depth of field covers it up. For macro, the margin of error is much, much thinner. You have to decide on the precise point you want to be in the sharpest focus, and set it yourself. Autofocus may choose a different point than you would, and a difference of even a millimeter can be enough to ruin a shot. Touch-screen focus using live view can get around this, but with a small screen such as the one on the back of your camera, the width of your finger may introduce unacceptable error. If you are remote controlling the camera via a tablet or large smartphone, you can probably get away with it with some practice.

After you ensure a lens has all of the features I just described, you are still not done. You have an important decision left to make: **focal length**. For Nikon full frame (24 by 36mm sensor) cameras, for example, the following macro lenses are available: 40mm, 45mm, 50mm, 55mm, 60mm, 85mm, 90mm, 100mm, 105mm, and 200mm. Aside from some variations caused by aftermarket manufacturers looking to be different, why all the choice, and do you need them all?

Macro photographers choose the focal length of their macro lenses based in large part on what they are shooting. For example, live insects can be spooked if you get too close. Insect photographers therefore tend to choose longer lenses. The 40mm lens requires you to be about 3cm from your subject to get a 1:1 reproduction ratio, while the 200 mm lens achieves the same 1:1 at 48cm. However, the price of a longer lens is inevitably size, weight, maximum aperture, and often cost. If you are interested in a particular subject matter, talk to other club members with similar interests or look at internet blogs and magazine articles (be aware that some of these are sponsored, or have odd ideas).

Choice of focal length is also about personal vision and preference. Different focal lengths provide different 'looks.' Wide angle lenses include more background, and provide greater inherent depth of field. Narrow angle (more telephoto) lenses restrict the background, and have shallower depth of field for same aperture. You are the only one who can make this choice.

So, do you have to break the bank to do this close-up stuff? Not really. If you are interested in a particular subject matter, you will probably only want one macro lens. Even serious close-up photographers often only have one dedicated macro lens. For example, I have a 45mm f2.8 (90mm FF/E). It covers 80% percentage of my close-up photography. I supplement it with a 14-140mm zoom (28-280 FF/E), which I use at 80-100mm (160-200 FF/E) with an extension tube, and a 30mm (60mm FF/E) prime, also used with an extension tube. Neither is ideal, but on my budget they are good enough.