



Extension Tubes and Close Up Photography

A 13mm EOS EF/EFS Extension tube on the Canon EF 50mm F1.8 STM lens

An extension tube is simply a cylinder that fits in between your camera body and the lens. This causes the lens to move farther from the sensor.

The additional distance allows your lens to focus more closely, which in turn provides more magnification. Unlike other lens accessories, extension tubes don't add any extra optics, and are therefore relatively inexpensive devices.

The only exception being those tubes which carry all the electrical contacts to allow aperture and auto focus control.

An extension tube increases lens **magnification** by an amount equal to the **extension length divided by the lens focal length**. For example, adding a 25 mm extension tube to a 50 mm lens will give a magnification gain of 0.5X. (this assumes that the lens is focussed at infinity). If the lens is focussed at a closer distance then some adjustment is needed to include the internal focussing change of the lens.

Here the formula becomes:

Magnification = Extension length + (Focal length of lens x Closest Magnification of lens) divided by Lens Focal Length

(Closest magnification is normally specified in the modern lens specification, meaning with no extension tube fitted)

Therefore, with the closest focussing if a typical 50mm lens's original magnification was 0.15X, then the new magnification will be $(25 \times (50 \times 0.15))/50 = 0.65X$. The closest focusing distance will also decrease to around 210 mm.

Extension tubes provide minimal magnification when used with telephoto lenses, however they can be used to decrease the working distance of the lens to the subject

An extension tube is usually specified in terms of its extension length in millimetres. Most manufacturers provide a range of extensions from 8-35 mm, although multiple extension tubes can be stacked to increase the extension even farther.

Image quality shouldn't be a factor when deciding between different brands of extension tubes (after all none have extra optical components).

However, build quality may be an important consideration particularly if you plan on using it with a heavy telephoto lens as contact separation may be an issue on cheaper brands. Metal flanges being preferable to plastic ones and there should be no axial “play” between the tubes.



To get even greater magnification you can use a “bellows” unit. The only downside is that these do not provide the electronic connection to the lens for autofocus or aperture control. If using an automatic lens you will need to preset the aperture before installing on the bellows.



Depending on your camera type this may be difficult to achieve but with Canon cameras you need to dial in the aperture, press the depth of field preview button and then keeping the button depressed remove the lens.

The arrangement of the contact pins in the camera breaks the 5V dc supply to the lens first and so the aperture motor stays locked at the preset position. Some cameras may need the setup to be changed to allow shooting “without lens”.

You normally focus by moving the camera to and from the subject and not by using the lens focus ring (which might not be available when the lens is on a bellows unit).

For this it is best to use the camera on some sort of short focus rail or camera slider.

With high magnification where the resulting depth of field will be very shallow several images taken at different focus positions may be needed to enable them to be assembled into one image using a focus stacking program such as Helicon Soft, Adobe Photoshop or Affinity 2.

The camera will still be able to control exposure by adjusting shutter speed and or ISO or if you are using flash to expose the subject lock the shutter speed and ISO and vary the power of the flash to obtain the correct exposure.

One variation of this that I used is to use a second hand enlarger lens mounted in an old body cap. Aperture can be controlled and the lens has the advantage that it has been designed to provide a flat field with little distortion.

They can be found in 50mm and 75mm types. I prefer the 75mm as it provides greater working distances.





Above is an image captured with the 75mm enlarger lens with the bellows set at a 50mm extension. The lens was stopped down to F8 and I used the Godox TT350C flash unit and Godox XPRO 1C remote flash trigger. The head of the model is about 15mm tall. Focus stacking is needed for these types of shot as shown below with 4 images stacked as each image has only a 3mm DOF.



Now there might be a “Light Bulb” moment here!

What about the use of vintage film camera lenses with manual focussing and manual aperture control?

The answer here is a definite YES! The lenses don't even need to be the same camera mount system as you are not expecting infinity focus and so any lens adaptors can be used.

For example I have Several Pentax K mount lenses which I use on my Canon EOS systems with a very slim PK to EOS adaptor ring.

By using this combination and extension tubes (or bellows) I can get some very good results. Magnification is easily calculated for any specific job or I just try different tube lengths until I get the image size that I need. Focussing is always achieved by moving the camera and not by adjusting the lens.



Two of my favourite closeup set ups: The SMC 50mm F1.8 Pentax K mount and the Pentax 23-80mm K mount lenses with Pentax K to EOS adaptor and a 13mm Extension tube. MCOPLUS MR14Xenon Ring Flash unit.



Image captured with the 50mm Pentax Lens @ F11 and infinity Focus Doll was 30cms to sensor



Image captured with the 50mm Pentax Lens @ F11 at the closest focus distance of 18cms to sensor



Image from the 23-80mm Pentax lens at 23mm @ F16 infinity focus 70cms sensor to doll



Image from the 23-80mm Lens at 80mm @ F16 closest focus 34cms sensor to doll

Note the very shallow DOF even at F16 using this combination, again focus stacking will be needed.



A set of 4 images combined with Helicon Soft Focus stacking program

Lighting can be a difficult challenge when setting up for these close up images.

You can use natural window light plus a white reflector or use simple LED table lamps however for capturing good images with controlled modelling it may be best to use some form of flash unit.

This is best if is "off-camera" - as seen in the case of the stacked image of the fisherman however you can use one of the many "ring LED lights", LED Ring Flashes or conventional Xenon tube ring flashes to achieve good results.

In the main these units provide shadowless lighting.

Beware many of the so called LED ring flashes are not providing a sufficiently short enough light pulse to capture hand held images.

Whereas Xenon tubes can give 1/1000 sec or shorter durations at close distances some of the LED ring light/flashes may have ¼ sec exposure and rely on your cameras flash synch speed of 1/60 sec to capture the actual exposure.



The MCOPLUS MRF18 LED Ring Flash has 18 LED light chips around the ring. They can be switched on as a left bank, right bank or both banks on together to create some modelling effect from the lights. You can fit a soft white diffuser or a CTO orange filter for giving Tungsten 3200K effect.



An image captured using the MCOPLUS LED Ring Flash



Rather than the LED ring flashes be used in the “flash mode” they can be set to provide continuous light. This light has the same strength as the pulse of light in flash mode. It can be beneficial in locating catchlights and shadows etc



These ring flash units give very characteristic circular catchlights in the eyes of your subject which can be edited out if you find them obtrusive.



Finally many of the enlarger lenses that are available have an L39 thread. You can purchase L39 to EOS M or EOS EF mounts and use these with fixed extension tube or bellows. Magnification is set by the amount of extension and focus achieved by positioning the camera. Excellent results achievable with 50mm lenses

