Supermacro-Photosystem: Instructions

Equipment:

Canon EOS 80D body, with battery charger
Canon MP-E 65mm f/2.8 1-5x super macro lens
Canon MT-24EX Macro Twin Lite flash
Kaiser RS1 camera stand
Novoflex Castel-L focusing rack
Acer TravelMate|P laptop computer
USB cable to connect camera to laptop

Currently everything is installed in Christoph's office. Feel free to use it there.

Preliminary Remarks:

Taking pictures with a super macro lens is a little trickier than with a normal lens. The lens doesn't let much light in, so you will almost always use a flash, and the depth of field is minimal. So forget about autofocus, automatic exposure control etc. The only ring on the lens is to choose the desired magnification, to focus you simply move the camera closer or further away from the object you want to photograph. That is why the camera is mounted on a focusing rack.

The super macro lens allows you to go really close, but because of the limited depth of field, extreme close-up images of 3-dimensional object will mostly be blurry. The way around this problem is to take multiple pictures of the same object with different focus (e.g. one with the focus in the front of the object, a second with the focus in the middle, a third with the focus at the back). These images can then be computationally combined into a single image with a wider depth of field. This is called focus stacking and can be done with the software ZereneStacker, which is installed on the same laptop computer that can be used to control the camera. The results get even better when you take more than 3 pictures.

Taking pictures using the camera stand & laptop

1) Turn on camera (power switch is adjacent to mode dial)
   Check if battery is charged. If not, remove battery and charge (charger stored near photo system)
2) Set camera's mode dial on M (manual mode)
3) Turn on the flash. It is ready when the red pilot light glows. If this is taking very long, the batteries need changing. Flash mode should be on ETTL (otherwise change with Mode button).
4) Turn on laptop. Use ECO-VOFO\Macro-System, password = CanonEOS80D
5) Open 'EOS Utility' software, select 'Remote Shooting', activate 'Live View Shoot'
6) In the 'Remote Live View window', turn 'Depth-of-field preview' ON. You will see a blurry live image from the camera.
7) Place your object under the lens, select desired magnification by turning the ring on the lens, and focus by moving the camera (camera stand for big movements, focusing rack for fine adjustment).
8) Once you are reasonably happy with what you see, adjust camera settings (EOS 80D window).
   A good starting point is 1/100 s exposure time, F8.0 aperture, ISO 200. Leave other settings.
9) Open 'Flash function settings' to adjust flash intensity correction. A good starting point is somewhere between 0 and +1.
10) Take a first test image by clicking the trigger in the EOS 80D window.
    The image will be displayed and saved to a dated folder in the Pictures Library.
11) Check if you are happy with the lighting of the image. If not, make adjustments.
    If the image is too light or too dark, I would first work with the flash intensity correction (give

more or less flashlight). That usually does the trick.
If that alone doesn't give a good result, work with camera settings. Either adjust:
- ISO (lower numbers are lower sensitivity = darker pictures and vice versa)
- Exposure time (the shorter the darker, although the effect is limited with short flashlight pulses)
- Aperture (smaller numbers = wider aperture = more light, and vice versa)

12) Once the lighting looks reasonable, take a series of pictures with different focus. Start with focusing on the point of the motif that is closest to the camera, shoot, move the camera a little closer, shoot, move it closer, shoot, etc. until you reach the point furthest away from the camera that you would still like to have in focus. Anything between 2 and max. 7-8 pictures will work.

A comment on the number of pictures:
If your motif is completely still, it is better to take more pictures with the Aperture quite open (between F4.0 and F8.0). This aperture will give you brighter pictures with higher resolution but a lower depth of field. The latter doesn't matter because you can take many and stack them.
If your motif doesn't sit still, you may not have the time to take very many pictures. Then it is better to take only 2-3 but with a more narrow Aperture (let's say F10.0 – F14.0). Each individual picture will then have a higher depth of field, but it comes at the cost of lower resolution.
The same is true if you want to take only one picture (no focus-stacking). Then you need to close the Aperture as much as possible to get a reasonable depth of field.

A comment on flash light:
Flash light is very bright and directed (hard light), leading to reflections and black shadows that may not look very nice in your pictures. This can be amended by diffusing the flash light to create a softer illumination. An easy way to achieve this with our macro setup is to place the motif in its own 'diffuser'. That can be a white bowl of partially transparent plastic, or simply a ring made of white paper, or something more clever that you invent yourself. The flash will then be directed onto this ring from the outside, such that the motif is reached only by the much softer light that diffused through the ring. Obviously, some light will be lost and you may have to adjust the settings to get pictures that are bright enough, but this is really worth trying if you don't like the hard light you get from direct flash exposure.

Using the camera in different positions:
You probably find the photo system set up with the camera facing downward, i.e. as if you wanted to take a picture of something lying flat, for example the page of a book. However, the camera does not have to be used this way. Without taking the camera off the stand, the different screws on the camera stand and the focusing rack allow putting the camera in a horizontal position, either in protrait or landscape format. For some objects this position may be better suited.

Taking pictures 'free-handed'

This camera does not have to be mounted on a stand and controlled via a laptop to take pictures. It is a standard digital SLR, so you can also use use it 'free-handed' or mounted on a normal tripod, e.g. if you need to take pictures outdoors. The extreme magnification and the very narrow depth of field of our lens make this 'free-handed' photography quite tricky (you might be spending most of your time trying to find your object in the viewfinder), but with some practice, you might also get nice results. I will not provide detailed instructions for this kind of photography. The rules for taking good pictures are exactly the same, you just need to control the settings directly on the camera and the flash, respectively.

Focus-stacking multiple images

1) Open the Zerene Stacker program installed on the laptop
2) File -> Add File(s)
   Select the images you want to stack
3) Stack -> Align & Stack All (PMax)
   The software will now take some time to stack the images. When it's done, the focus-stacked image will be displayed. There are two stacking algorithms (PMax and DMax), you can also choose to do both, but PMax is the normal option and should work just fine.
4) Save the focus-stacked image if that is all you want to keep.
5) Save everything as a project if you want to work on the same images again.
6) Remove all the pictures you made from the laptop and move them to your own computer. What is not deleted will periodically be deleted by Christoph to avoid filling up the hard disk (these are large files!).

An example of five pictures with different focus stacked into one (*Geranium robertianum*)

Enhancing pictures

Installed on the photosystem laptop is Canon's software 'Digital Photo Professional 4'. This is quite a powerful tool to enhance your stacked pictures even more (sharpness, color intensity, contrast, etc.). I will not give detailed instructions here, because like any software, it needs to be tried. You may also be more familiar with Photoshop or some other software that might work just as well for you as Canon's product would.

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