

Using a Canon EOS M50 as a Dedicated, Afocal, Microscope Camera – Revisited

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[Earlier](#), I shared my experience with the Canon M50 over my Leitz Ortholux I microscope. Here I share a few more things I hope are worthwhile.

Errata:

I wrote in the End Notes: “A single tap on the screen of your mobile device moves the focus rectangle to the tapped position. A double-tap anywhere on the screen, **optically** zooms into that rectangle . . .” That should, of course, have read **digitally** zooms, as noted elsewhere in the body of the article.

Worse, I used a Leica 10x high-eyepoint in my set-up experiments. That was wrong. I should have used a 170mm-era 10x high-eyepoint eyepiece in the Ortholux I’s trinoc tube.

Frustratingly, I had read the [Leitz 160mm memo](#) more than once before but always focused on the objectives rather than the eyepiece advice.¹

The M50 vs. 4K revisited . . .

In the Conclusion of that article I wrote: “But I would love to stream ‘live view’ 4K.”

Footnote #5 did offer some hope:

1 It is easy to tell the difference because 160mm Leitz eyepieces display the field index number while 170mm eyepieces do not. Here is a comparison between the two – the correct-for-my-Ortholux, 170 mm era Leitz 10x high-eyepoint on the left, and the Leica 10x high-eyepoint on the right (using the 160mm design). Circled, in red, is the field index number on the Leica, which is noticeably missing from the 170mm version. Notice too, that the 160mm eyepiece is about 8mm longer above the top of the eyepiece tube, reflecting the new, higher location of the intermediary image as noted in the memo (i.e. 10mm below the top of the eyepiece tube vs. the older 18mm).



“⁵ i.e. 1080p – The M50 does not support 4K ‘live view’. But Canon tech support did reply to my questions as follows: ‘With the EOS Utility the resolution depends on your screen and how large you have the window. If you are doing 4K recording through the USB to the EOS Utility the live view screen can match a 4K display if it is full screened. Depending on the computer you may see stuttering displaying it at that resolution.’”

In my earlier testing I had used Canon’s mobile device software – ‘Camera Connect’ -- for live-view/remote-control of the M50, as well as feeding the M50’s HDMI output to a monitor. BUT I had evaluated Canon’s PC/Mac software -- ‘EOS Utility’ -- with a borrowed laptop that did not support 4K.

This bothered me . . . and so retested using a 4K capable PC.

Results: 4K? Not really. Despite Canon Support’s assertion, my testing shows the M50 still feeding a 2Mb view (i.e. 1080p) of the sensor in a 4K stream to the EOS Utility. So that has not gotten us anywhere. True, the image on the monitor is 4K, but with only 1080p’s worth of pixel information in the live view of the sensor.

Canon Tech support had also warned in another message that the feed “**would not be clean**” and I puzzled over that statement a bit. It turns out that ‘clean’ in ‘camera speak’ means full screen with no menus or UI taking up any of the screen space. Of course, EOS Utility wraps the live view in a UI and so by that definition it is not a ‘clean’.

Another issue is the 30-minute time-out I wrote about in the Notes section. Professional photographers/vloggers want clean, continuous 4K live-view monitoring, and, strictly speaking, the M50 can do neither.²

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2Criteria	2What Photographers Want	2What the M50 offers	2Comments
2Clean	2Full, unobstructed, view of the sensor in 4K.	2Via HDMI: A full, unobstructed view of the sensor in 1080p. Via USB: A non-clean (i.e. wrapped in the UI) 4K stream of a 1080p view of the sensor (i.e. only with 2Mb worth of pixel information).	2To me, the UI-wrapped view of the sensor is very adequate, but then again, I am not vlogging with the camera as more main-line users do. I have not experienced stuttering.
2Continuous	2No interruptions of the sensor view with no overheating.	230-minute time-out (i.e. sleep), at which point you have to ‘touch’ the camera controls to re-initiate the stream	2Not a problem if a 30-minute video is long enough (e.g. for time-lapse work it might not be) – a simple procedure ‘wakes up’ the stream. I have not seen any overheating. A Mr. Binh Dong seems to agree.

Continuous Mode – High Speed & Low Speed

You can set the M50 to take 10 shots a second (i.e. high-speed continuous mode) or 3 shots a second (i.e. low-speed continuous mode) as you click on, and hold down, the shot button. This capability features as part of the 'Sports Mode' of the M50 for use in shooting rapid movement with high-speed, autofocus, in competitive sports, for instance. In my case, I am targeting rapidly moving protozoa, albeit without autofocus, but still useful for dealing with a wildly gyrating nematode or worm, as examples. When you've 'rack-up' a stack of shots, you can then quickly and easily vet the images, either through Camera Connect or EOS Utility, pick the best ones, and discard the rest. All this without taking the SD card out or even touching the camera.

Digital Zoom – So Nice!

Having digital zoom capability, for the paltry price of a double mouse click, is a game-changer. The M50 can zoom 5x or 10x, and you can change this with a mouse click, and then back to 1x as desired.

Typical procedure before:

- Scan the slide with the lowest power objective.
 - When seeing something interesting and worthy of investigation, switch to a higher power objective and refocus (there are always slight parfocal mismatches between objectives even with shims).
 - If interesting, keep investigating, by switching to even higher power objectives, and refocusing.
 - Not interesting? Rotate back to the lower power objective and correct focus before continuing scanning

Typical procedure after:

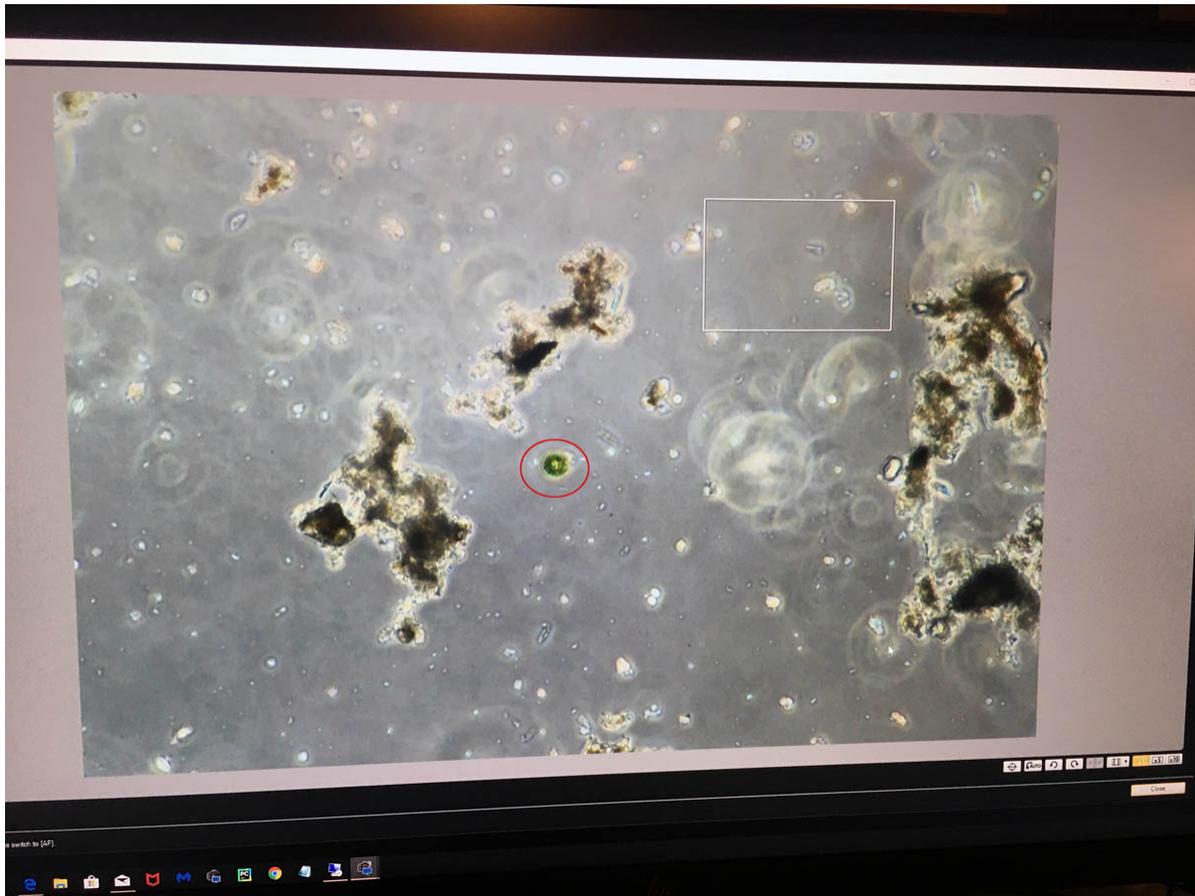
- Scan the slide with the lowest power objective.
 - When seeing something interesting and worthy of investigation, **double-click on the subject (You do not need to center the subject – any area of the screen is 'good') and zoom to 5x. Need more power? Click the 10x button.**
 - If interesting, keep investigating, by switching to even higher power objectives, and refocusing.
 - Not interesting? **Double-click again (or choose the 1x button) and continue scanning the slide.**

The 2nd procedure, with digital zoom, is much faster and more satisfying, at least to me.³

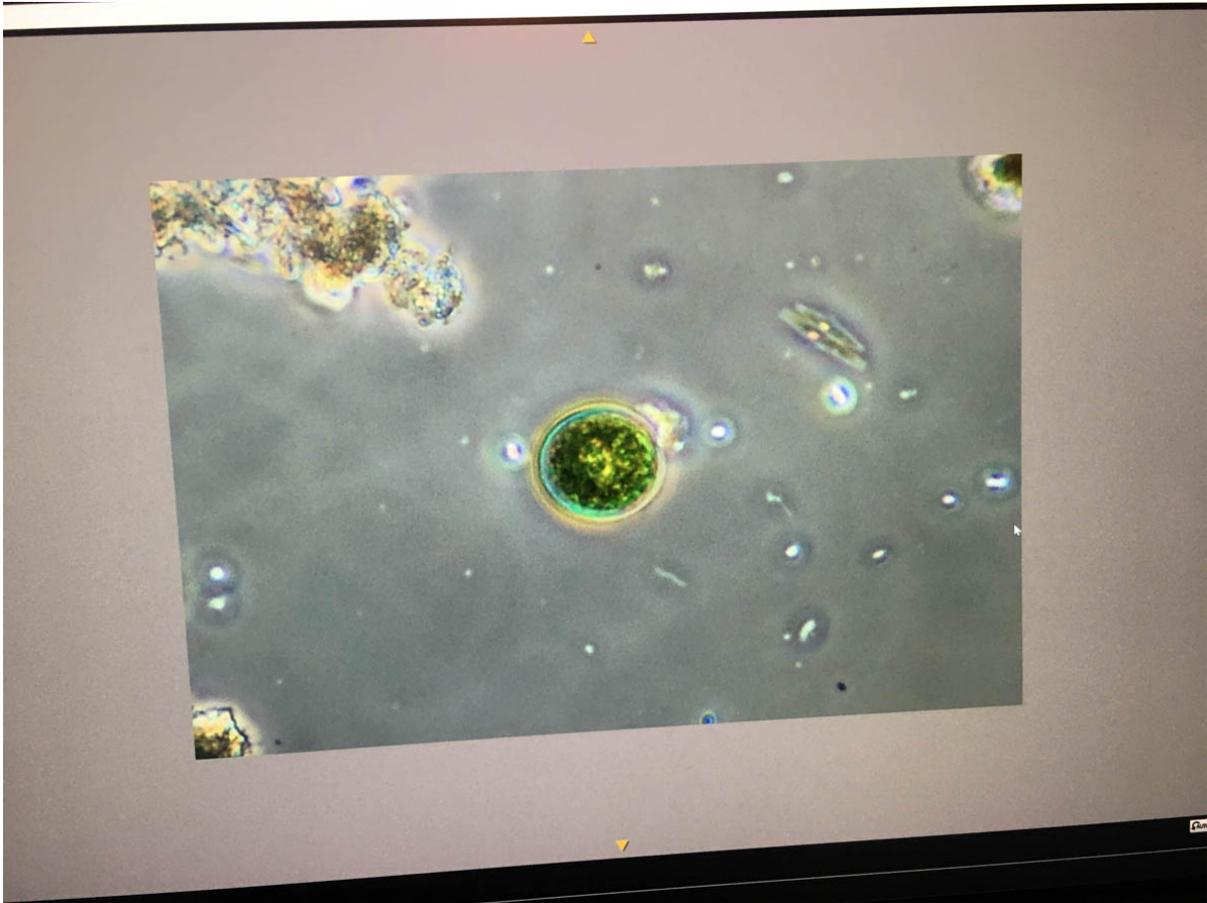
³ There are times when observing pond water that the water sample is too thick beneath the coverslip to safely allow moving the higher power objectives into place (e.g. the 40x objective, with its smaller working distance). Digital zoom then really is the only tool you can use to increase visibility of obscure features, at least until evaporation thins the height of the 'micro-aquarium' you have built between slide and coverslip.

Here is an example in pictures . . .

While scanning with the low power objective I notice the green oval circled in red below:



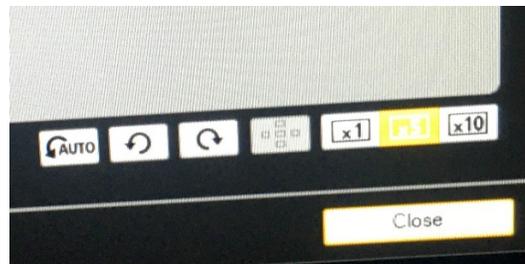
Although this green blob is near the center of the field-of-view, it wouldn't matter if it were otherwise. Double-clicking anywhere on the screen centers the white 'zoom' rectangle (you can see it in the upper right of the screen) on the first click and zooms to 5x at the same time.



It appears to be a [Euglena](#) in its resting stage?

At this point, you can click the 10x button to digitally zoom even further if you want an even

more magnified view . . .





True, at 5x or 10x you are deep into ‘empty magnification’, but that is not the point. The point is that you can see better whether you want to investigate with a higher power (and higher N.A.) lens or move on.

Of course, these ‘zooms’ are not static images, they are live, digitally zoomed displays from the USB (or HDMI) stream’s 2MB view of the 24MB sensor. You can even choose to stay in this 10x (or 5x) view if you want and scan around the slide.⁴

To get back to scanning, you can double-click again (or click the 1x button).

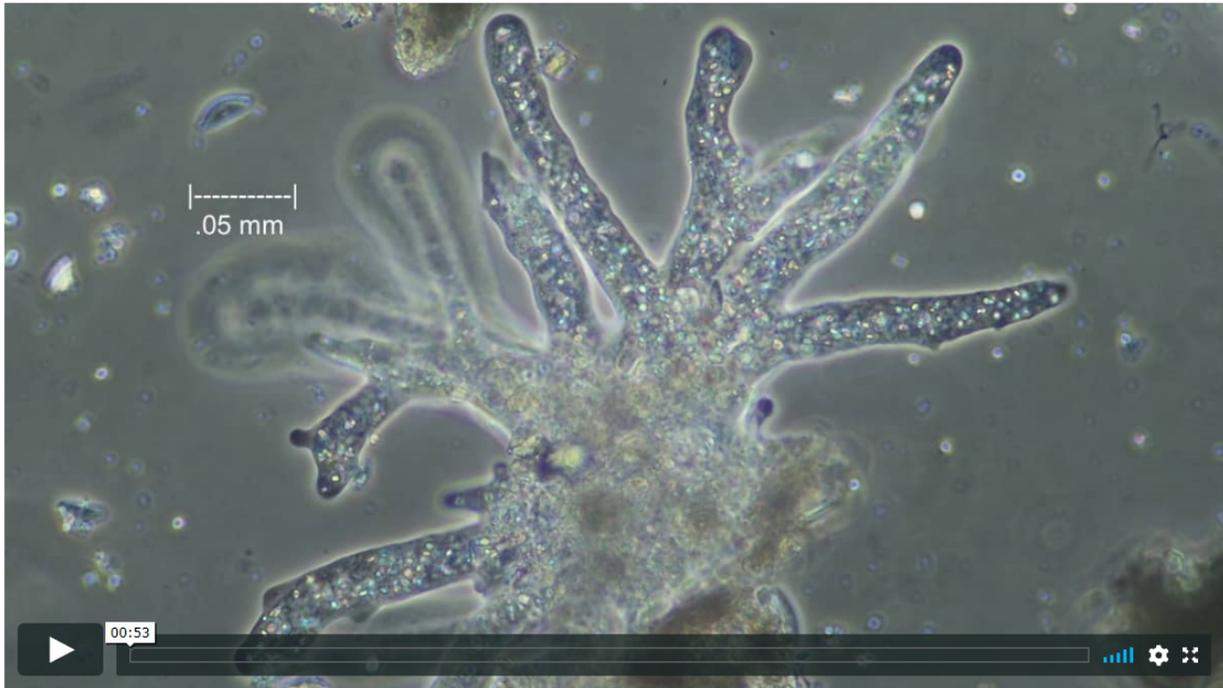
Having Video Capability Always at Hand . . .

In my earlier article, I wrote, “[you can switch back and forth easily from photo to video mode, and back to photo mode, very quickly, and without touching the camera.](#)” As an example, I was scanning a slide of pond water from a park near my home when the ‘monster’ below crawled out of a clump of detritus. Switching to video took only a couple of seconds.

⁴ Changing the objective while in either a 5x or 10x zoom can result in a ‘white-out’/over-saturation condition with the image. Not a problem, per se, but it is startling the first few times you see it. The fix is to get out of zoom -- before white out happens, or after, it does not matter – by double-clicking or using the 1x button.

Please click on the image below to play the Vimeo video:

<https://vimeo.com/364606528>



Above: An amoeba, in phase contrast, showing the 3D nature of its movement pattern.

What is it? My guess: [Chaos](#). I called my daughter-in-law over to view the screen. She had never seen an amoeba and luckily this amoeba was not the typical smallish example. “It’s full of crystals?!” she cried. Why yes. Yes, it is.

Note: My refocusing during the video was not only to show her the extent of the amoeba, but also to show its three-dimensional structure. It hunts and searches in three dimensions, not just ‘flat’ against the top of the slide as she expected. When you watch the video, you will see it has reached up to briefly explore the bottom of the coverslip and has pseudopods and body suspended between coverslip and slide at times. It seems it could easily ‘step over’ obstacles as needed, and switch to either surface, above and below, or both, at once.

When Will Looking at The Screen Be Just as Good as Looking Through the Eyepiece?

Dave Jackson does some analysis that might help answer this⁵.

Here is a table combining data from three tables in Dave’s book that shows the situation from what I can tell:

5 D.J. Jackson, Section 3.9 of Volume III of the ‘Better Microscopy’ series: Digital Photo-Microscopy

Objective (Magnification & N.A)	Microscope's Intermediate Image detail in lw/mm (linewidths per mm).	Megapixels (Mp) needed in a 'view' of the sensor on a monitor.
4x/0.10	182 lw/mm	10 Mp
10x/0.25	182 lw/mm	10 Mp
20x/0.40	146 lw/mm	6 Mp
40x/0.65	118 lw/mm	5 Mp

There is also the Bayer filter problem that means you need more than the minimum to reveal the finest details because colors in specimens matter and sometimes this means that only 75% of the pixels are useful in forming the image on the camera sensor.

Bottom line: 4K streaming, with its 8Mb of pixels, is close to adequate with a 20x objective and greater. You would need more for the 10x objective. To be absolutely 'there' with any of the common objectives, and most research objectives, you would need 6K streaming (6K streaming offers a whopping 18+ Mp of detail!)⁶.

The M50 streams a 2Mb view of the sensor. So as wonderful as it is on the monitor, we are still far away from replacing the view from the eyepiece. Professional vloggers (and photographers) are 'our friends' here. While the market for higher density streaming for the microscope hobbyist is, well, micro, the market for vloggers and moviemakers is big and growing bigger. Our interests align though 'they' do not know it.

Final Comments

That is already probably too much about the M50. Sorry for the overload. Right now, to get proper 4K streaming from a Canon camera, at least, I would need to upgrade to an EOS R. That is about 4.5x the price I paid for the M50! So, as I noted in the prior article: "Give it a couple of years". Or, four?

But watch with me? Canon is not the only 'game in town' and competition is fierce in the camera world. Report on what you find back here on Micscape?

Comments to the author Steve Neeley are welcomed, email psneeley AT xmission DOT com.

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www.micscape.org

⁶ Dave notes that the human eye can resolve 270 lw/mm with a 10x eyepiece, so the human eye 'view' is usually constrained by the limitations of the objective and only a research grade 10x objective with an N.A. of 0.40 can offer more detail in the microscope's intermediate image than the eye can consume (i.e. 290 lw/mm).