Examining the Microlinks Technology Co., Ltd. UM-CAM

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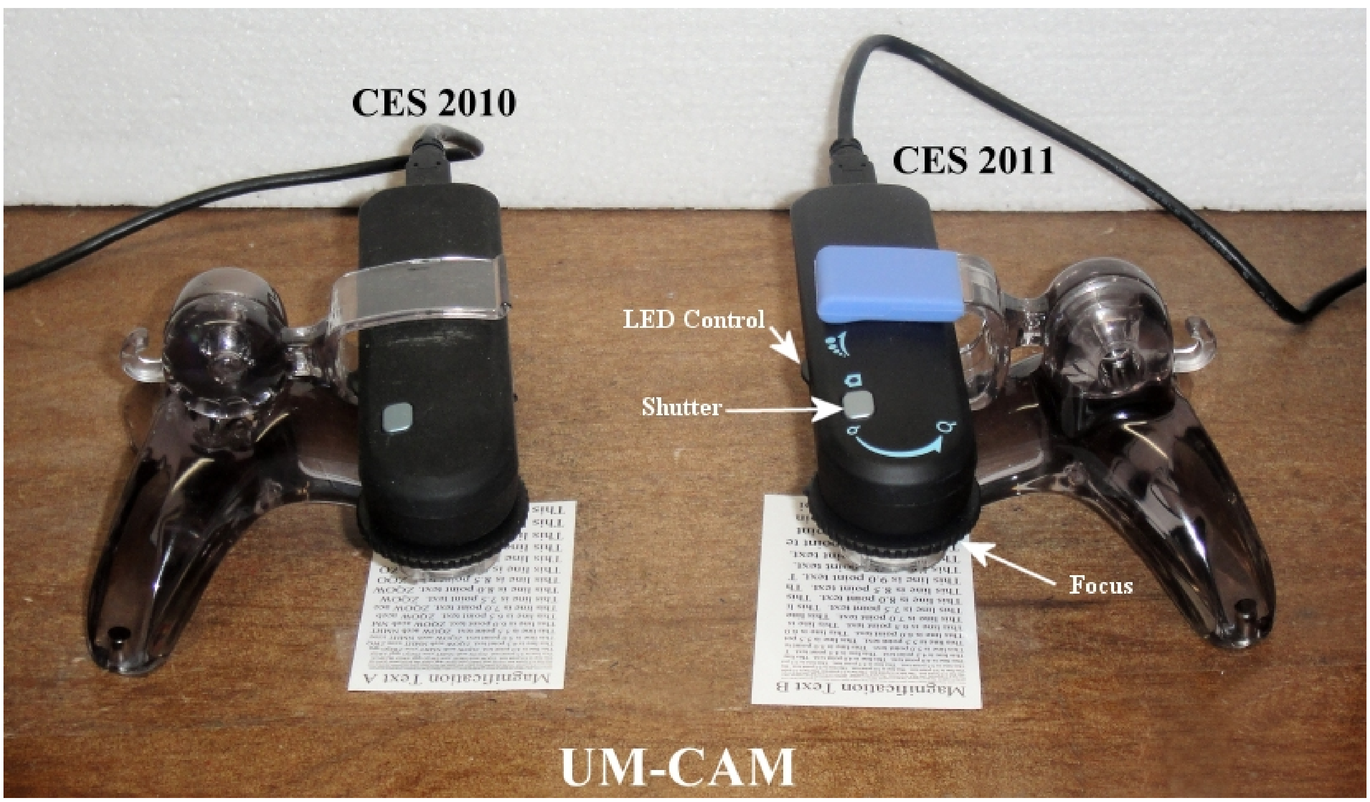
Introduction

I usually buy "show specials" at the Las Vegas January Consumer Electronics Shows that I have attended for over 40 consecutive shows. Last year I bought a Microlinks Technology UM-CAM USB microscope to test and explore. I used a five dollar bill as a subject to illustrate the capability of the UM-CAM in 2010. See:

http://www.msscweb.org/public/articles/Exploring_a_New_Five_Dollar_Bill.pdf

The 2 megapixel (1600 x 1200) UM-CAM is attractive because it is advertised to work both as a webcam and as a USB microscope. This year I once again visited the Microlinks Technology booth, ViTiny™, and they said that they had improved their UM-CAM in three ways.

1. They now include a test film with the product - as seen in Fig. 7d.
2. The software is improved with added features including a scale and the ability to make measurements – not part of this article/review.
3. The holder and case have been improved (mostly cosmetic) - as seen in blue Fig. 1.



TX! Photo

Fig. 1 – Last year's and this year's CES Show Specials are compared. It is a USB microscope and a webcam.

The UM-CAM is quite handy and easy to use with its wide range of focus from a few mm to several meters. It has its own white LED lighting for use in the very close microscope application. The four LEDs are brightness level controlled to fully off. See Fig. 1 above. Also see Fig. 2 which is a self-portrait made by photographing a mirror. The clear plastic ring is removable so you may to gain an additional 1 mm closer to the lens system.

The UM-CAM is light weight and easy to hold and use. The focus ring is convenient with a 3/4 turn, but the shutter button is a bit of an issue when used in the stand; I usually use the mouse to take the photo.

UM photo

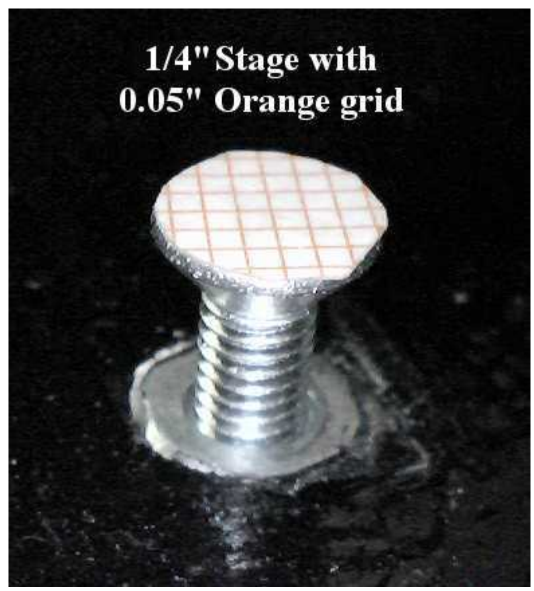
Fig. 2 – Four white LEDs light the small specimen..

Each leg of the UM- CAM stand has a neodymium magnet which allows it to be held to a metal surface. I built a simple “L” stand with metal “brackets” bought at home depot screw attached to the two vertical surfaces and the horizontal surface to hold the UM-CAM. See Fig. 3.

The subject/specimen is placed on a wood base, visible in Fig. 3, that has a 9/32” hole drilled 1-1/2” from the end. The nut from a ¾” long #6-32 flat head machine screw is pressed into the hole. The head of the machine screw is covered with white, black, or graph paper attached with double sided tape to make a specimen stage. See Fig. 4. Use water resistant coated stock if you have it available.

TX! Photo

Fig. 3 – Metal covered wood “book end” stand for the UM-CAM.



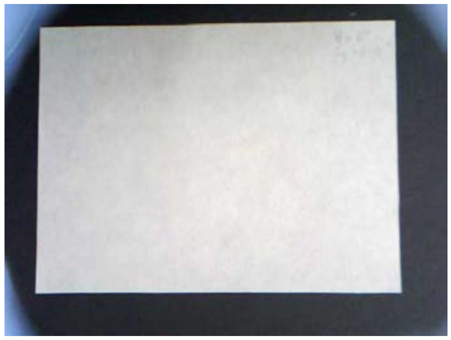
UM photo

Fig. 4 – Small specimen stage with grid. UM photo.

USB Microscope Performance

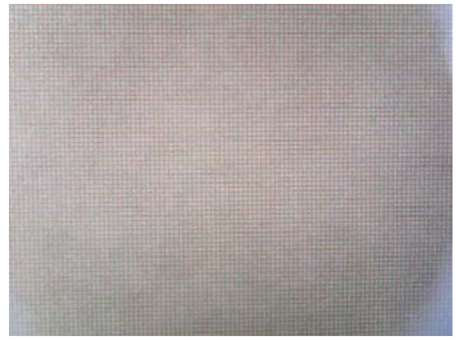
The performance of the UM-CAM as a webcam is very poor. The most effective camera-subject distance is touching the camera plastic ring (Fig. 2) to about a foot away. I decided to examine this by photographing a sheet of orange graph paper –does anyone use graph paper anymore? I cut a piece of graph paper eight inches across and six inches high (1600 x 1200 pixel aspect ratio) placed on a sheet of solid black paper. I took five photographs starting at 14.5 inches as shown in Fig. 5a. The orange grid lines are 0.05 inches (1.52 mm) apart.

Fig. 5a shows that the resolution (more on this later) is so poor that you don't even recognize the image as graph paper. I then cut the camera distance in half to 7-1/4 inches. Note the corners. This is also noticeable in Fig. 5b. Even at this distance you will still notice that the optics system is not well aligned. It gets worse as you go further away. Look at the right side corners. I moved the camera closer to the paper and Fig. 5c shows the grid at three inches. I printed this page and measured the grid dimension at 0.082 inches which makes the magnification 1.64x. The camera was then moved right up to and touching the clear plastic ring (see Fig. 2) and the image of Fig. 5d was captured.



UM photo

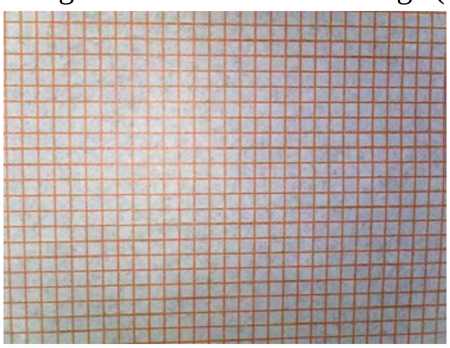
Fig. 5a – Graph paper at 14.5 inches.



UM photo

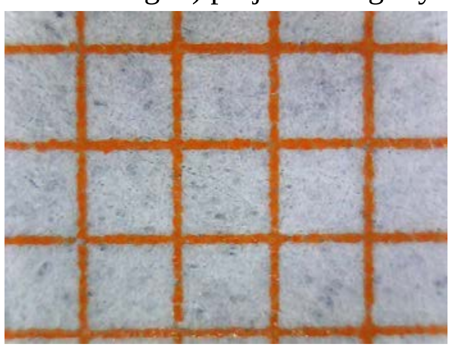
Fig. 5b – Graph paper at 7 inches.

Using the 1/4 inch diameter stage (shown in Fig. 4) projected slightly into the camera provides the highest possible magnification as shown in Fig. 5e. The magnification is 31x as noted. This represents the absolute highest possible magnification using a very small subject. Of course using a larger sized image such as what I see on my 19" LCD screen (orange grid spacing is 10 inches) the magnification is 10/.05 = 200. This is clearly what is often called empty (and useless) magnification. See Reference 3 Article.



UM photo

Fig. 5c – Graph paper at 3 inches. 1.64x

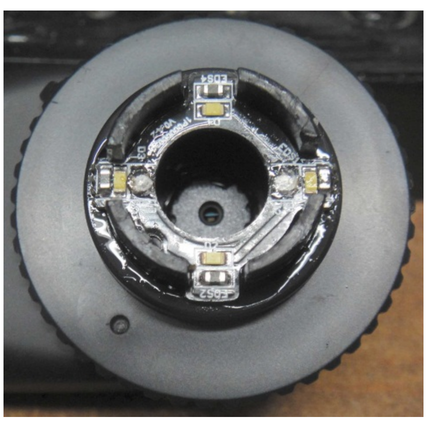


UM photo

Fig. 5d – Paper touching camera. 10.1x

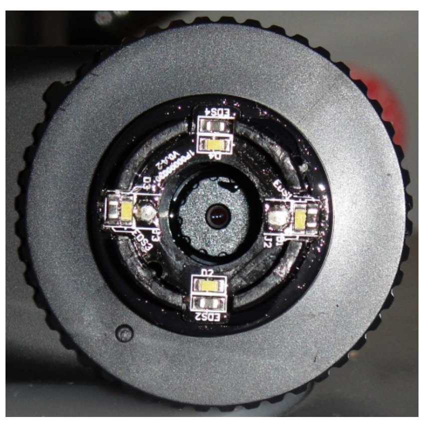
UM photo

Fig. 5e - Paper inside camera. 31.0x



TX! Photo

Fig. 6a – Camera lens fully retracted.



TX! Photo

Fig. 6b – Camera lens fully extended.

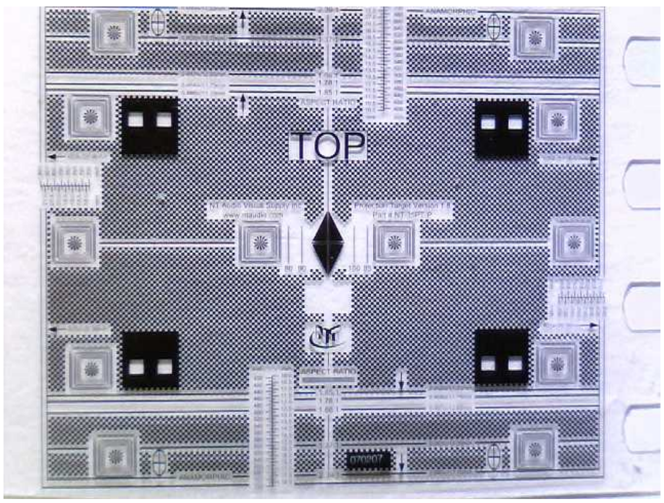
TX! Photo

Fig. 6c – 1/4" stage extended into camera.

A test frame intended for 35mm film was photographed and shown in Fig. 7. It is the same film as shown in Fig. 3. It includes three small short lines, sized, marked, and spaced to provide a measure of resolving an image in line pairs per millimeter. It is important to remember that the resolving capability of an optical system is independent of magnification. If you look carefully at Fig. 7b you will see that 24, 28, 34, & 40 line pairs are distinguishable. The three 48 line pairs are fuzzy. The resolution is 40 to 48 line pairs per mm.

How does the UM-CAM resolution compare to other systems? I took the very same photo with my Sony DSC-TX1, 10.2 megapixel digital camera with a Carl Zeiss Vario-Tessar lens. The result is shown in Fig. 7c. The Sony TX1 is not any better it just seems "better" because it has five times as many pixels.

To further illustrate this important microscope parameter I examined the same film under my Nikon stereo zoom microscope. I do not have a quick and easy way of taking a photo of that image. All of the line pairs shown in Fig. 7 were sharp and clear including the 80, 90, 100, & 85 line pairs.



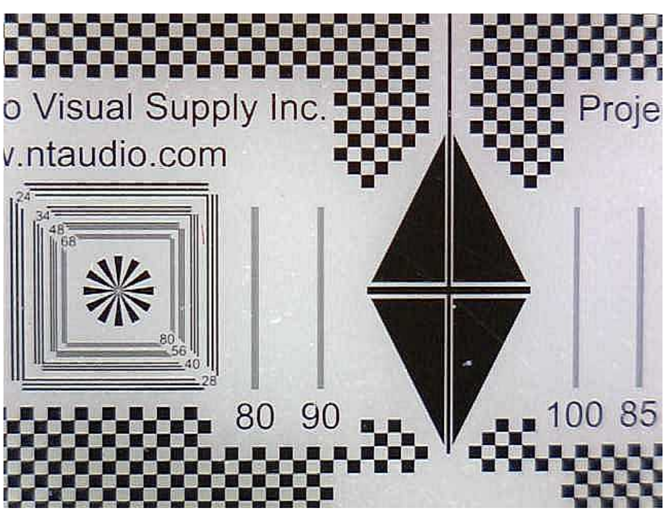
UM photo

Fig. 7a – 35 mm Test film used to measure resolution.

UM photo

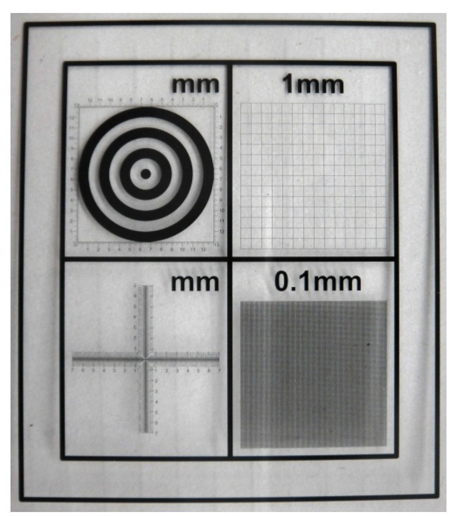
Fig. 7b – Resolution is between 40 and 48 line pairs per mm.

If you have a choice of doubling your resolution or doubling your magnification you should pick doubling your resolution. Low cost optical systems do not provide resolution specifications.



TX! Photo

Fig. 7c – Sony TX1 resolution is 40 to 48 line pairs per mm.



TX! Photo

Fig. 7d – UM-CMA test film.

One of the 2011 improvements of the current version of the UM-CAM is the inclusion of a test film that provides the patterns shown at the right. A specimen may be placed on the 1 mm or 0.1 mm grid to provide a a simple means of measurement. The software also imposes an in-photo scale to also provide a means of alignment and measurement.

Example Photographs

The primary advantage of the UM-CAM is that it is able to photograph a wide range of subject sizes to provide a “real” magnification to the maximum of 15x to 20x. I work with small electronics parts and this doubles the normal old school macro range - where the image is 1 to10 times larger on the film.

The primary UM-CAM disadvantage is that unless you have an “extra” conventional microscope stand with a rack and pinion focus you will spend additional time focusing[(1)] (positioning/sliding on the metal plate) your subject. There is one advantage to this however. You may more easily change the angle and viewing perspective as illustrated in Fig. 4.

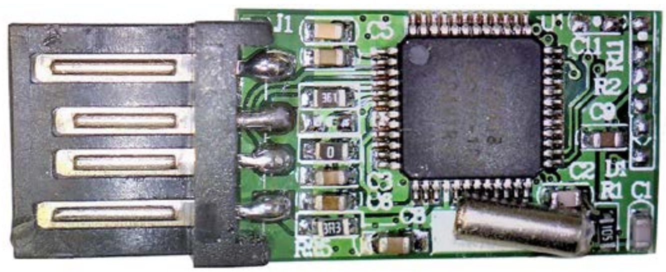
I decided to use one of my several CES freebee USB Flash drives as a photo subject. See Fig. 8. The rubber like “Thinkfinity” case facilitates having the USB drive assembly pulled out. The metal case is peeled open like opening any metal can – using a long nose pliers. The cased and uncased thumb drive is shown in Fig. 8b. You may see the pliers marks on the case. The metal case is useless after it is peeled open. Fig. 8c shows a better view of the circuit board and is composed of two halves being photographed and “spliced” together.

UM photo

Fig. 8a – One GB USB Drive.

UM photo

Fig. 8b – Out of the Case.

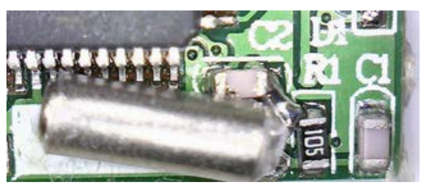


UM photo

Fig. 8c – Circuit board component side showing memory IC.

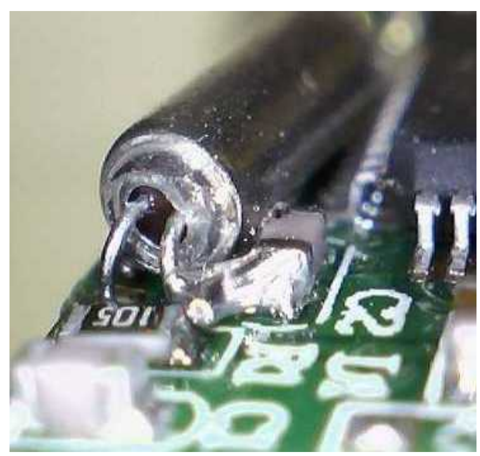
UM photo

Fig. 8d – IC, 48 leads with P/N.



UM photo

Fig. 8e – Quartz crystal detail. I worked in the quartz crystal industry for five years so I was curious about who made the crystal, what its frequency is, and how it is packaged. I took several crystal views in the photos that follow: Figs. 8f - 8h.



UM photo

Fig. 8f – Crystal leads and RC’s.

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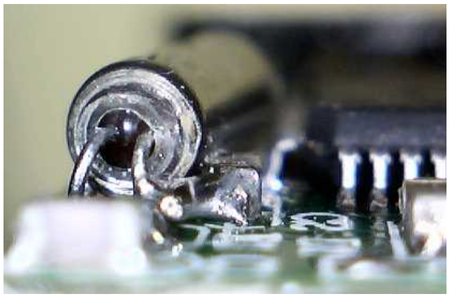
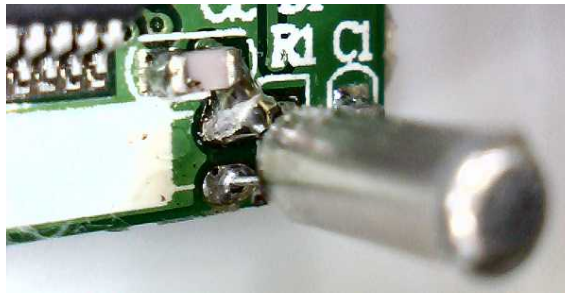
(1) Set the camera on the stand so the single leg is straight up – Fig. 3. Slide the UM-CAM to the approximate position and focus. If I am trying to fill the frame or align the image square in the frame I usually tap the legs with a large screw driver handle to make the final adjustments to position. Refocus as needed.

A close up of the memory IC allows the identification to be made and the pins counted. I was interested in the crystal so I got as close as possible to show various views of it. Fig. 8e shows that it is secured by double sided tape. I was interested in the leads so I took a photo of the lead end shown below in Fig. 8f. The closest possible view of the crystal leads is shown in the next photo in Fig. 8g. Note that the lead closest to C2 has excessive solder around it. Fig. 8h shows this better and Fig. 9 shows Fig 8c full page.



UM photo

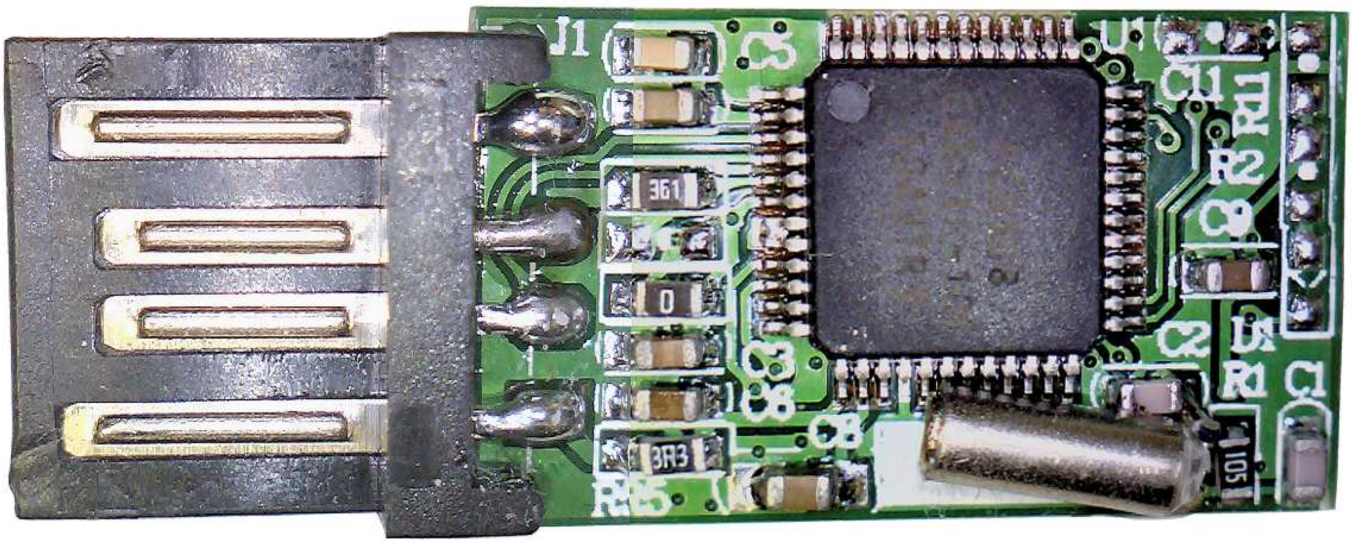
Fig. 8g. – Largest view of crystal.



UM photo

Fig. 8h – Unusual solder of XTAL lead.

Fig. 10 shows the set up for taking the various angles of the circuit board using a metal “bolt” and model clay to hold the circuit board in place.



UM two stitched photos

Fig. 9 – An “enlarged” version of Fig. 8c. How does the quality look? The assembly is 1.26” x 0.49” or 5.6x.

TX! Photo

Fig. 10 – Photo set up for circuit board.

The image of Fig. 9 is not super sharp but the UM-CAM serves a useful purpose at a very reasonable cost. ($50 to $100).

Fig. 10 shows how the photo of Fig. 8f was taken. The image on the LCD is shown in the background.

Software

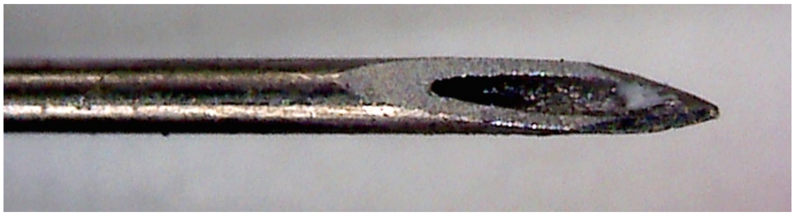
The software that comes on a small CD in the box is adequate and easily learned by trial and error – or reading the Manual.

There are some English word typos and there is the normal “you wonder what they were thinking” in the way things are done, but the biggest criticism I have of all of the USB microscope software programs that I have used is simple. You spend 15 minutes getting the subject/specimen set up and you need to take the photo.

The programs make it too difficult to "press the shutter" aside from the models that have a button on the camera itself. A single key on the keyboard should be all that is needed – the space key! All in all it is useable and you can easily get photos like those shown here.

Additional UM-CAM photo examples.

Figs 11 - 17 show a diverse range of subject/specimens.

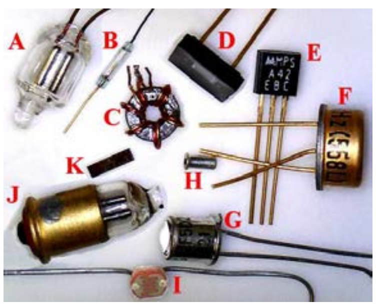


All three UM photos

Left Fig. 11a – Tiny neon lamp. Top Fig. 11b – 30 Ga. syringe needle after 100 uses. Note rubber. Right Fig. 11c – Beard showing chin hair.

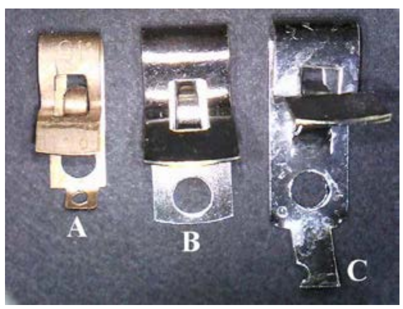
The group of small electronics parts shown in Fig. 12 are listed below.

A- Neon lamp, NE-2 type.
B- Reed switch, micro size, NO.
C- Toroid transformer.
D- Photovoltaic cell.
E- NPN transistor w/ EBC lead marks.
F- Quartz crystal, tuning fork.
G- GE F5D2 photo diode.
H- Circuit board lead socket.
I- Cadmium Sulfide cell.
J- Neon lamp.
K- Integrated circuit. It has markings on it - see Fig. 15.



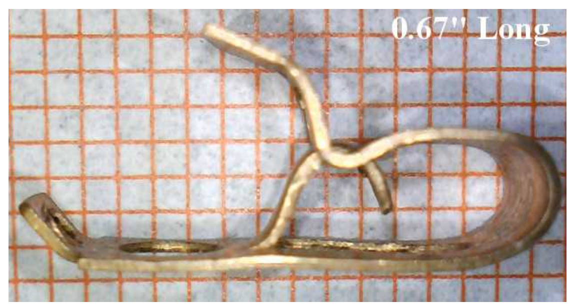
UM photo

Fig. 12 – Electronics parts.



UM photo

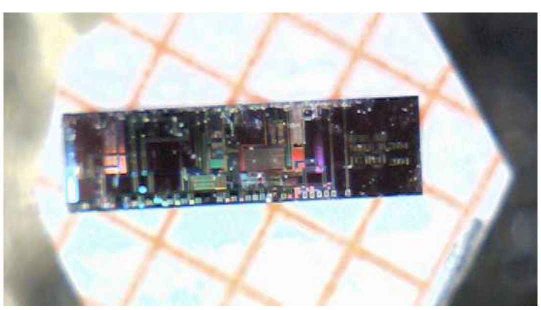
Fig. 13 – Fahnestock clips.



UM photo

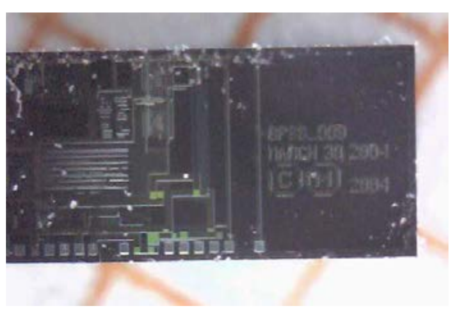
Fig. 14 – Fig. 13"A" small copper clip.

The IC silicone chip, Fig. 12 item "K", will be used to again test the UM-CAM maximum capabilities. I wanted to read the markings at the end of the IC. IC's represent one of the more interesting challenges in resolution, magnification, and lighting. Fig. 14 shows the IC on the ¼" stage with the 0.05" grid graph paper.



UM photo

Fig. 14 – Fig. 12 IC closer - text markings?



UM photo

Fig. 15 – IC, maximum magnification.

My Nikon stereo microscope provides a nice clear image of the lettering (large by IC standards). This example represents the best resolution possible by this low cost USB microscope. High resolution is vital for a microscope.

Observations and Conclusions

Examining the Microlinks Technology Co., Ltd. UM-CAM and writing this article was a fun project. The homemade stand and base with adjustable 1/4 inch stage makes it much easier to use as a more conventional microscope. The effective magnification is in the 10x to 20x range with a 40 to 48 line pairs per millimeter resolution. For comparison my 0.5x to 40x Nikon stereo zoom microscope has a resolution exceeding 100 line pairs per millimeter as measured with the 35 mm test film described in the text. The wide focusing range and additional magnification using a 1/4 inch adjustable stage to extend the subject/ specimen into the camera a few extra millimeters greatly enhances the utility of the USB microscope. Twenty six example photos taken with the UM-CAM are included.

The UM-CAM is advertised as a webcam, but it is not very well suited for this purpose.

Adjusting the LED brightness and the focusing takes a little practice for the best results because of the automatic video camera control electronics which may take up a second or more to adjust from extremes of brightness and contrast.

The nice advantage of this particular camera among the hundreds of USB microscope cameras available is its stand, focus ring, and it's low cost.

A supplemental article that discusses magnification (and resolution) is listed in the references along with another USB microscope review article and an article on An Illuminated (back lighted) Stage.

Richard J. Nelson
February 13, 2011

Comments are welcome at rjnelsoncf@cox.net

References

1. UM-CAM Owner's manual:

   http://www.docstoc.com/docs/42155230/UM-CAM-Application-Program-Operates-Manual

2. Link for previous UM-CAM article, 2010.

   http://www.msscweb.org/public/articles/Exploring_a_New_Five_Dollar_Bill.pdf

3. A related article describing conventional microscope magnification compared with digital USB microscope magnification, Titled *Microscope Magnification* may, also be found on this website.

4. A related article titled *Examining the Able Eye EHEV3-USBUV USB Uv Microscope* may also be found on this website.

5. A related article titled *An Illuminated Stage* may also be found on this website. This article describes a simple low cost fluorescent lamp and a (dimmable) LED lamp microscope stage especially suitable for use with USB Microscopes.