The Imaging Source DMK21AF04 Firewire Camera

by Tony Gondola

The DMK21AF04 with 1/14″ nosepiece adapter (supplied with AS-Astronomy version).

Imaging Source's box of tricks

As a dedicated lunar imager I'm always on the look-out for improved techniques and hardware. About a year ago, I started hearing about the industrial-use cameras marketed by The Imaging Source out of Bremen, Germany.

At the time, the camera every lunar and planetary imager wanted was the Luminera Infinity2-1M but at nearly $US2000 ($AUD2400) that camera was way out of the reach for many. When I started seeing the excellent results people were getting with The Imaging Source Cameras that were selling for less then $US500 (AUD$600), I really felt it was worth a look.

Left: Rear view with 6-Pin IEEE Firewire connector.

Below: Cables.

The DMK21AF04 is an 8-bit monochrome CCD Firewire camera built around Sony's ICX098BL CCD sensor. The ¼″ progressive scan chip has a 640x480, 5.6x5.6 micron pixel array with a quoted sensitivity of 0.5 Lux at 1/30th second integration time, 20 dB gain. Shutter speeds range from a frame freezing 1/10000 sec. down to 30 seconds. A firmware update is available that extends the long exposure time out to a full 60 minutes. Available frame rates range from 3.75 FPS to a very fast 60 FPS.

For those of us used to webcams and related consumer level products, you can tell right out of the box that this camera is going to be a different experience. The 50mm square camera housing is beautifully crafted out of blue and black anodised aluminium giving the imager a very solid, industrial feel … no plastic found here. The case sports a C/CS lens mount, 6-pin Firewire port and a solid aluminium, threaded tripod block. Total weight is 256 g.

Also included with the camera are the usual drivers, capture program and a Visual Basic code collection that can be used to write your own control and capture applications. For coupling to a telescope you'll need a C to 1¼″ nosepiece adapter (supplied with AS version). This is a standard item that's now available from a number of vendors that include Steven Mogg at Mogg Adapters: *www.MoggAdapters.com*

Because of variations in application, a Firewire cable in not included in the base price. For Windows users it's important to note that the standard Firewire cable is made up of six wires, four for data and control and two for power. Most Windows laptops have a 4-pin plug (data only) so you'll have to order the separate power supply and the pigtail 4- to 6-pin cable along with the camera. If you already have the 6-pin plug then a standard 6-pin firewire cable is all that's needed. The camera operates on 8V to 30V DC via 6-pin firewire port (~200 mA @ 12V). >>

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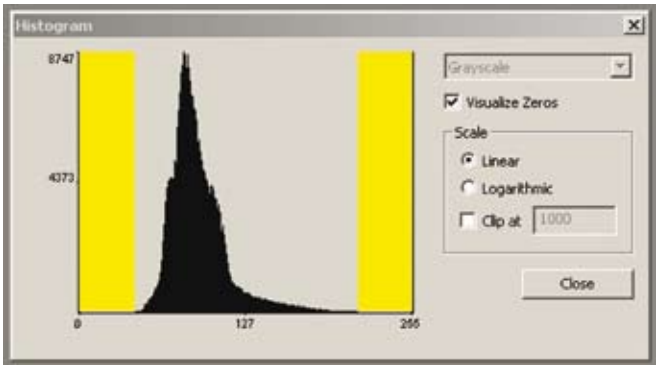
Installing the software and getting the camera up and running for the first time went smoothly with everything working as advertised. The only problem encountered over the last six months of operation is an occasional difficulty with detecting the camera when it's first plugged in. I suspect this is OS-related rather than an actual problem with the camera itself or the capture program. Hot plugging the camera always brings it up and from then on it's stable.

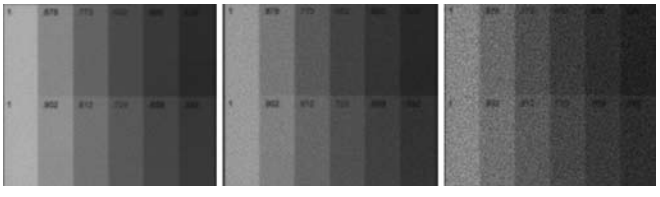
The included capture software, IC Capture, is a surprisingly powerful program with a few great unusual features. The various settings and control windows can be placed anywhere on the screen and the live image is resizable, making it easy to customise your on-screen setup, making all settings and controls available 'on the fly'. I especially like the live *histogram display*, which is the best I've seen in any capture program. The *visualise zeros* function makes it easy to avoid clipping. This is a critical function that many capture programs seem to overlook.



Live histogram.

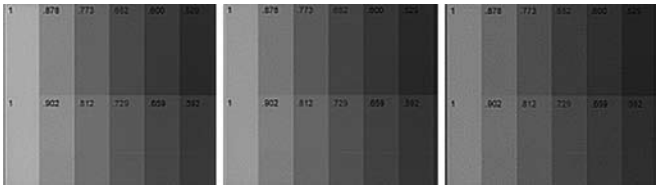
IC Capture also supports other functions such as single image capture, frame or time limit capture and interval shooting. You won't find any astrophotography-specific functions such as guiding and telescope control but for basic capture operations, IC works extremely well.

With any camera used for astrophotography, noise is always an issue. To test the DMK I photographed a gray scale chart at 0%, 50% and 100% gain. 148x130 pixel sections were cropped out and scaled up 400% to make the patterns easier to see. Here's the result:



Raw noise.

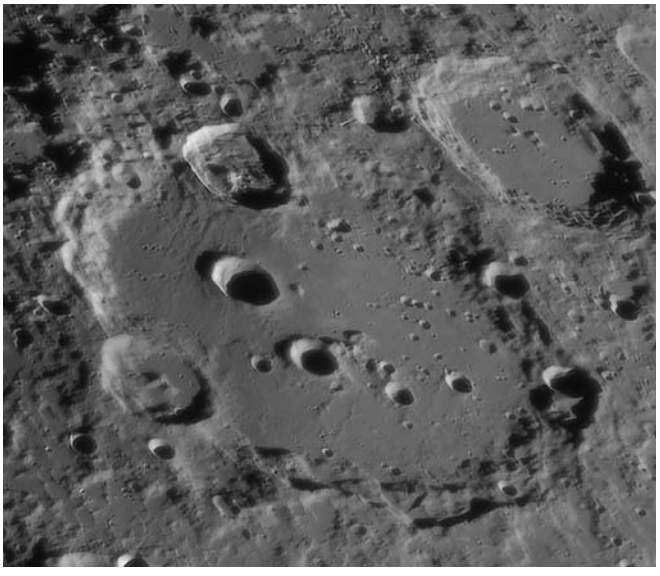
To find out just how this might impact actual imaging I stacked 200 frames at each gain setting and then applied a standard amount of wavelet sharpening to each frame:



200 frame stack plus wavelets noise.

This result shows that noise is very well controlled with maximum gain settings providing usable results with minimal stacking depths. This noise level is lower then any webcam-based imager I've used. Sensitivity of the camera is such that most of my lunar imaging is done just above the 50% gain setting. That really makes noise a non-factor when applying typical sharpening processes.

To see what the camera is capable of with real astronomical targets here are a few examples:



Crater Clavius, 200-frame stack, gain 60%, 1/74 sec at 60 FPS, Ulead compression.

Jupiter and moons.

As these image show, the dynamic range of the camera is about as good as one might expect from an 8-bit imager. Internal processing is done in 10 bits before conversion – so, no doubt that helps a bit here.

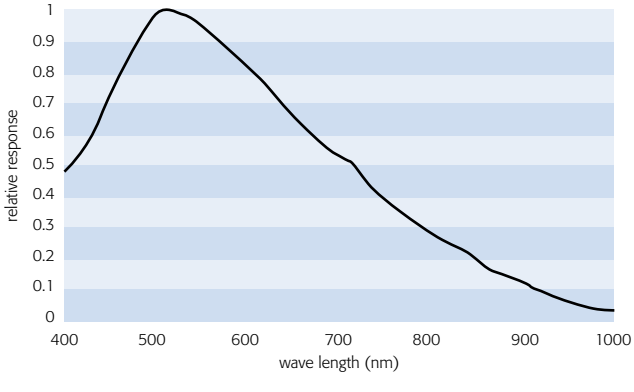
At this point I should say a word about frame rates and compression. In the past, typically it has been the rule that one never uses compression of any kind when gathering AVI data. The DMK cameras all come with a free copy of Ulead's lossless compression codec. I was sceptical at first but after extensive testing among a number of imagers, the general consensus was that compression had no visible effect on the resulting images. The adjacent image 'Jupiter and moons' certainly proves the point.

The ability to use compression is really a plus. For a 2000 frame AVI file, compression shrinks the file down from a whopping 600,000KB to a very reasonable 80,000KB. The ability to do this has a number of advantages but the biggest one is that it allows smooth imaging at 60 FPS. This is a huge advantage in lunar, solar or planetary imaging where one has to gather as many frames as possible within a set time limit.

Although the DMK is best suited for lunar, solar and planetary imaging it does have enough sensitivity and enough long-exposure capability to have some use as a guider and DSO imager. In fact, The Imaging Source offers a number of cameras in the line as '.AS' versions that are specifically adjusted for long exposure use. In my own testing from my magnitude 5.5 location the camera reaches the 25% histogram sky fog point in less then 30 seconds at F/4. Sensor sensitivity peaks at about 510 nm with about 65% sensitivity at the important Ha wavelength.

The image 'Messier-42' above is a typical example of the long exposure capability of the camera. More imaging examples can be found on The Imaging Source astronomical cameras blog site at: *www.astronomycamerasblog.com*

Messier-42.



Sensitivity graph.

Obviously an 8-bit camera isn't going to be anyone's first choice for DSO imaging. Still, it's nice to have even limited capability. The camera has application as both a DSO imager and as a 'live view' ocular replacement, something that's becoming more and more popular for general observing and for Public Outreach.

To recap, if you're looking for a reasonably priced, rugged, high performance camera for lunar, planetary or solar work that also has some utility as a guider and DSO imager, the DMK line of cameras from The Imaging Source is worth a look. Both colour and monochrome cameras are available with sensor sizes ranging from 640x480 up to 1280x960. For more information visit the IC web site at: *www.TheImagingSource.com* ●

Tony Gondola is a graduate of the New England School of Photography, past president of the Santa Fe Amateur Astronomers and an active member of AAVSO. In his 'spare' time, he also makes top quality mirrors for Newtonian telescopes for use by ATMs. Tony has now moved to better skies in New Mexico and he is happy to answer any questions you might have – he can be contacted at: tony@digital-flight.com