

Blackmagic BMPCC4K and Nauticam NA-BMPCCII

by The Backscatter Team

The Blackmagic Design Pocket Cinema Camera 4K (or BMPCC4K for short) is one of the best cameras ever for capturing cinematic 4K 60p video. It possesses a unique combination of Micro Four Thirds sensor/lens system and the ability to shoot RAW video, resulting in a camera that is portable, affordable, and produces some of the best video image quality that we've ever seen from a camera in this budget range.

There's also a companion model to this camera with an even higher resolution sensor: the BMPCC6K. The 6K version uses a Super 35 sensor and Canon EF Mount lenses, which overall offer more resolution and a wider variety of high-end optics to use. Our testing was only performed with the BMPCC4K, but we will include comparisons where relevant if considering the 6K option.

Many of the features that make the BMPCC4K so unique and powerful also carry some significant caveats and need-to-know workflow details, especially in the post-production stage.

ProRes for easy video, RAW for advanced

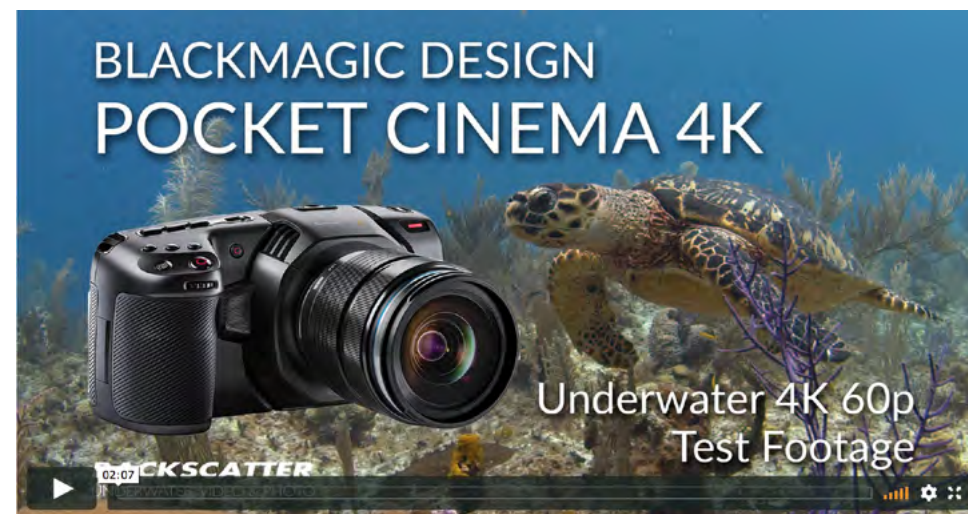
The BMPCC4K offers two options for video recording: ProRes and RAW. ProRes is awesome because it records uncompressed video, which may not offer as much latitude for editing and correction in post as RAW, but still preserves basically the highest level of image quality and allows for a less-intensive video editing workflow. RAW video is extremely powerful for non-degrading corrections to color and exposure. We take a deep dive into the RAW capabilities of the camera, as well as how we achieved ideal results from our test clips and what caveats users need to be aware of. Read on for a detailed breakdown of our workflow.

The clips that make up our test footage are an equal mix of RAW and ProRes, and after appropriate color correction and grading, the final product is basically indistinguishable. The only significant difference between recording in the two different codes is how much range for exposure and color correction there is during editing.



The BMPCC4K and the BMPCC6K. Our review focuses primarily on the BMPCC4K.

All of the necessary controls are right at your fingertips with the NA-BMPCCII



Take a look at our mesmerizing BMPCC4K Test Footage to see the cinematic power produced by this pocket-sized video platform.



ProRes clips don't offer as much correction range as RAW video, but they still hold up just fine when significant White Balance correction is required. Image captured from video.

Super sharp shadow and highlight detail

The BMPCC4K has 13 stops of dynamic range that provide a great level of detail in the brightest highlights and darkest shadows. This is some of the best low light and ambient light only performance we have ever seen from a camera of this sensor size. The BMPCC4K offers fantastic performance for a Micro Four Thirds sensor, which does not collect as much light as larger full-frame sensors, yet in this case still delivers results that significantly raise the bar.

4K DCI video at 60 frames per second

4K at 60 frames per second is the standard for pro-level video performance from a consumer camera. Many cameras can shoot 4K video resolution, but only a limited number

can do so at 60 frames per second (or 60p for short).

60p video is great (especially underwater) for slowing down to 24p or 30p playback for a slow-motion effect, which adds stability and doubles the duration of your clip.

At the time of this review, the only other 4K 60p comparable cameras are the Panasonic GH5 and Panasonic S1, and the Canon 1DX II - all of which capture 4K from a smaller portion of their sensors than the BMPCC4K does. The Panasonic GH5 is the only other Micro Four Thirds sensor camera, while the Panasonic S1 and Canon 1DX II are both full-frame.

The BMPCC4K takes 4K a step further by capturing 4K DCI resolution at 4096 pixels wide, which is wider than the more common 4K UHD resolution (3840 pixels wide). This provides a more cinematic aspect ratio, as well as additional



When shooting with only ambient light in a backlit scene the BMPCC4K produced fantastic details in the highlights and shadows. It produces outstanding natural light results. Image captured from video.

space to compensate with if digitally stabilizing clips in post. If shooting the BMPCC6K, you'll have about 1/3rd more resolution to work with, for an insane amount of latitude in post to stabilize, crop, and get creative with your footage.

Micro four thirds sensor and lens mount

The Micro Four Thirds (MFT) system is an industry-standard lens mount and sensor size system that allows for cross-compatibility of lenses that utilize an MFT mount. MFT will be familiar to mirrorless Panasonic and Olympus shooters, as

it was developed and is used by both camera makers.

The affordability, versatility, and great results produced by Micro Four Thirds lenses have made them very popular for underwater photographers, with lenses like the Olympus 14-42mm, Panasonic 8mm Fisheye, and Olympus 60mm Lens macro now considered standard lenses among current mirrorless shooters.

Our test footage was shot using the Panasonic 8mm Fisheye lens and the Olympus 14-42mm Zoom lens behind a Nauticam WWL-1 wide angle conversion lens.



A wide range of Micro Four Thirds lenses are available. We love these lenses for their portability and affordability compared to full-frame optics.

Olympus 14-42mm, Olympus 7-14mm Pro, Olympus 9-18mm, Panasonic 8mm, Olympus 8mm, Olympus 60mm Lenses

Touchscreen interface and controls

The BMPCC4K isn't unique only in performance. It is also a fairly unique body design compared to other current cameras, with a slightly wider and shorter body than similar mirrorless and SLR systems.

The 5-inch touchscreen on the back is very sharp and the touch controls are responsive and accurate. Colors look good on screen. The overall interface and menu navigation is very intuitive and easy to adjust to.

While the camera can be just about entirely operated from the touch screen itself, there are also dedicated function buttons for the most essential controls. There are dedicated controls for Record, Autofocus, ISO, White Balance, and Auto-Iris, as well as a single Command Dial.

By default, the command dial will control your Iris (or Aperture),

but it will take over when ISO or White Balance options are brought up on screen.

A beneficial cinema-like aspect of the camera is the ability to lock the shutter speed to a 180° angle. This guarantees a shutter speed that is always double our frame rate (typically 60p) so that our slow-motion footage maintains a natural sense of motion blur. In effect, this means that the shutter speed may be set once and never adjusted again, unless trying to achieve a specific look or exposure setting as desired.

The camera is powered by a single Canon LP-E6N style battery, but the runtime on this would be better to measure in minutes, not hours, because it drains extremely fast. Fortunately, the camera also offers a 12-volt power supply which we can utilize with an expanded power pack inside the underwater housing.



The 5-inch LCD screen is sharp, responsive, and produces good color.



Dedicated function buttons provide an alternative to the touchscreen for quick operation

Unique challenges and how to overcome them

There are several features that the BMPCC4K does not offer that are found on other 4K 60p cameras, like the Panasonic GH5, Panasonic S1, and Canon 1DX II. Fortunately, none of these are deal-breakers and once understood, pose very little drawback.

There is no in-body Image Stabilization (I.S.) on the BMPCC4K. In-body I.S. is commonplace among current mirrorless cameras, with some models (like the Panasonic S1) featuring up to 6 stops of stabilization. Video clips from the BMPCC4K do have noticeably more natural handshake than those from a camera with built-in I.S.

Fortunately this problem is easily compensated for. We applied a stabilizing effect in post and only lost about 1-2% resolution based on how little the clip needed to be cropped in. The 4K DCI resolution and the extra pixels it records provide most of the 1-2% resolution that we needed to achieve optimal clip stability. If using the BMPCC6K you'll have another 2000 pixels worth of resolution to work with when stabilizing in post.

The BMPCC4K does not have any continuous, tracking, or following autofocus modes. Single autofocus works great though, and some camera operators may also choose to utilize the manual focus ability for ultimate control. Many cinema cameras do not offer anything other than single autofocus, so while many mirrorless and SLR cameras have an advantage here, we cannot fairly hold this against the BMPCC4K. It should also be noted that the autofocus speed of the BMPCC4K was slowest among other 4K 60p capable cameras.

File sizes generated by the BMPCC4K, especially at best quality settings, are massive in comparison to just about every other comparable mirrorless and SLR camera. When shooting in either RAW or ProRes at the ideal settings for image quality the camera could record about 1 hour of media to 1TB storage device.

Even though the BMPCC4K can accept SD and Compact Flash cards, the huge file sizes dictate the use of a higher capacity media solution. The cool thing about this is that the camera can record directly to a Samsung 1TB SSD, which is relatively inexpensive, compact, and lightweight. It can even be mounted inside the housing ensuring the maximum amount of recording time without having to open the housing to exchange media.

Raw video for perfect color

The first rule of underwater video is that if the color isn't right, then nothing else in the clip really matters. Having the ability to correct the color (and exposure) of a clip on a metadata-level without incurring quality loss is one of the most beneficial abilities for the underwater videographer because it can allow for recovery of clips that had color and exposure slightly off in-camera.

A standout feature of the BMPCC4K is its ability to shoot RAW video. It does so using a proprietary Blackmagic Design video codec known as Blackmagic Raw, generating .BRAW video files. The power of RAW video is similar to that of shooting RAW photos; the exposure and color information within the image may be changed in post without causing damage or degradation to the original image.

This is a huge deal, because RAW video has



The NA-BMPCCII housing allows for a portable SSD to be installed, allowing the camera to record about 1 hour of RAW video before having to offload or swap media.

previously been locked behind 5-figure budgets on costly cameras like RED and ARRI. The fact that the BMPCC4K is only \$1,299 and manages to capture RAW video is just flat out awesome.

No other comparable camera produces video that even comes close to this level of editing power, giving the BMPCC4K hands-down the best video image quality in terms of color and correction.

The in-camera white balance value maxes out at 10,000K and has a maximum tint value of 50. During editing we can expand these values on a metadata-level to 50,000K and a maximum tint value of 150. This provides enough range to correct color on clips that were a little off the mark without incurring any detail or quality degradation.

How we handled the RAW video

The proprietary .BRAW files produced by the BMPCC4K cannot just be opened up and imported into any editing software. As a bonus to the camera owner, a free license for the Studio version of DaVinci Resolve is included with the camera purchase. DaVinci Resolve is an industry-standard for many professional editors and especially colorists. Many users prefer Resolve to other editing programs for its color correction and color grading tools and workflow.

REC 709 Color vs. RAW

Our eyes are used to seeing colors displayed on screen in a REC 709 color space. There's too much to cover about color space to go into detail in this article, but REC 709 can be quickly summarized as a more limited color gamut that has become the industry standard for the majority of TVs, monitors, and screens in our modern world.

When shot in RAW, the BMPCC4K is recording in a wider color gamut than REC 709 and is capturing much more color information than the limited spectrum that REC 709 allows. The downside to this is that the RAW image when displayed on screen appears very



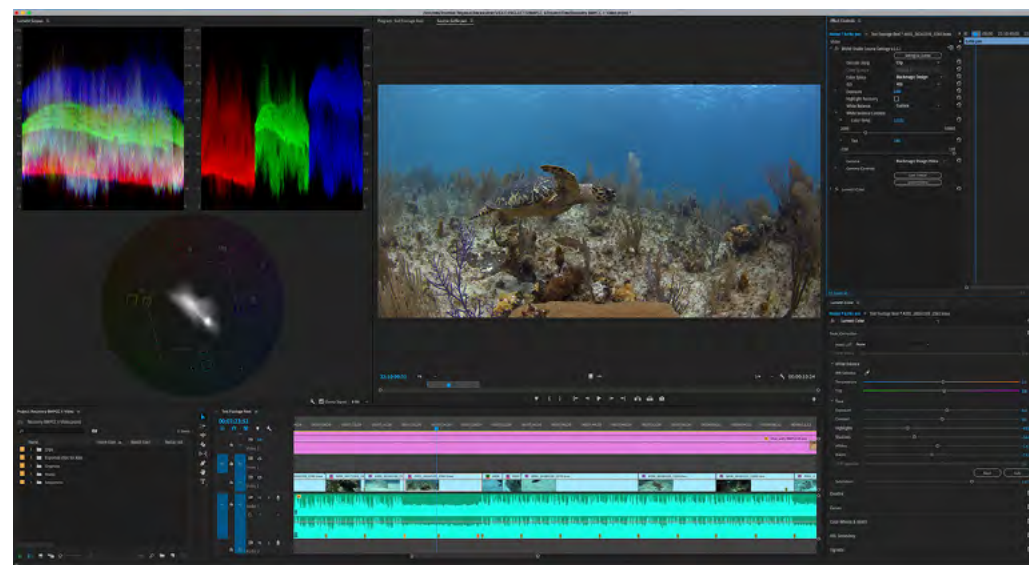
The BMPCC4K camera includes a license key for DaVinci Resolve Studio

neutral and flat. This is typical for RAW video previews but does not assist the shooter when determining color and exposure information. That is where a LUT comes into play.

Use a LUT (LookUp Table) to evaluate Color & Exposure

The easiest way to accurately evaluate color and exposure in-camera is by using a LookUp Table (or LUT). LUTs are an overlay on your image that transforms its look to one much closer to the final edited product. Shooting without a LUT is essentially shooting blind when it comes to exposure and color accuracy because the RAW image preview just doesn't provide enough info to us on its own.

You can even opt to have the camera "bake-in" the LUT you are using to your footage, making that specific look embedded directly into your video. This is good for turn-and-burn projects where you need to



It may look complicated at first, but color correcting and grading RAW footage from the BMPCC4K is easy once you get the workflow down

minimize time correcting color and exposure in post.

Getting the Look Right in Post

We found that the easiest method of obtaining good looking results in post was to use .BRAW 3:1 footage and apply a REC709 LUT. It's also possible to decode the RAW footage into a native REC709 color space, but this limits the colors and bit-depth available to work with on a metadata level, so why lose that info if we don't have to? Just apply your preset or custom LUT to the RAW clips, and then fine-tune the white balance and tint using the RAW editing panel. Further tweaks to exposure should be

performed using the Lumetri color effects. We found this to be the overall easiest and fastest way of getting great-looking results.

Housing Details - NAUTICAM NA-BMPCCII

At the time of this review, Nauticam is the only housing manufacturer producing a housing for the BMPCC4K. Their housing is the Nauticam NA-BMPCCII and we found it to offer some very practical advantages to this camera specifically for underwater use, where access to the camera body is restricted.

One of the coolest features is the built-in bracket for a portable Samsung SSD, allowing for 1+TB of



Four 18650 batteries greatly extend the runtime of the BMPCC4K

media storage directly in the housing. This is critical for having enough media storage to avoid having to do a card swap after every dive.

There is also an expandable battery holder which utilizes (4) 18650 batteries to significantly extend the runtime of the camera. This connects to the BMPCC4Ks AC power outlet, which the camera reads as being connected to wall power, so there is no percentage or battery level indication - only an AC power indicator. Our testing yielded at least two dives without the need for a battery swap, but err on the side of caution and recharge the batteries at least after every other dive to avoid mid-dive camera shut down.

The in-water operation of the camera is somewhat limited inside the housing because the camera relies so heavily on the touchscreen for operation. This is just fine because we have physical controls for all of the most essential functions: power, focus, exposure, white balance, and image review.

A dedicated control wheel on

the front is your primary interface for aperture/iris value, and as your scroll control for other options. There are controls for ISO, white balance, autofocus, and 3 custom function buttons all right at your fingertips. You also get a manual focus control wheel, a button to punch-in and magnify the image to check critical focus, and additional controls for auto-iris, high frame rate toggle, still photo capture, and the main menu.

The 3 custom function buttons are highly programmable, with a lot of different functions that come in handy. We switched between using Zebra Striping, Focus Peaking, False Color, Preset White Balance, and applying LUTs on these buttons to have even more control over the camera and our images while underwater.

It is worth noting that due to the lack of touchscreen control, media review is limited in the housing. Depending on the camera setting, it is only possible to either review only your last recorded clip, or play all recorded media in sequence. It's also impossible to delete or manage



All of the necessary controls are right at your fingertips with the NA-BMPCCII

clips in-camera, so once that space is recorded on your drive or card, it will be on there until you can connect to a computer. This is a very cinema-style feature, and while sometimes inconvenient, is still fairly in character with this style of camera.

A benefit of the BMPCC4K is that the 5-inch screen is so big, you don't need a monitor for a large, sharp image to review. It looks great on the built-in screen.

The N85 port opening is perfect for the smaller Micro Four-Thirds lenses and allows for a variety of dome, macro, and wide conversion ports to get the best shots underwater.

Nauticam also plans to support the BMPCC6K with an N120 port sized housing in the near future, and we will update this article with a link when it is formally announced.



Who should use the BMPCC4K?

Who is the BMPCC4K for? The underwater video enthusiast that wants to step up to the next level of video quality without a 5-figure budget. At only \$1,300, this system is insanely affordable for the image quality it produces.

This is hands-down the best video quality among all current 4K 60p SLR and mirrorless cameras, but it also requires the most work in post.

To make the most of it, you'll want to have some color correcting and grading experience in post, but even if you don't already have this, the BMPCC4K is a fantastic system to learn on. It's easier than most people think and you'd be surprised what you can learn with just a YouTube tutorial or two.

Altogether it's not that different than any other SLR or mirrorless camera because the color must still be captured accurately even when shooting RAW. The difference is that you have more dynamic range and color depth to work with and fine-tune without degradation or further compression and quality loss. In effect, you have more latitude to tweak your footage, but RAW is not magic and you still must pay attention to color and exposure while shooting.

Shooting RAW video is certainly not for everyone. While the results are fantastic, it will take you significantly more time to color correct every clip. If you'd prefer to keep your editing time to a minimum, cameras such as

the Panasonic GH5, Panasonic GH5s, and Canon 1DX II have much better underwater white balance allowing you to get your color right in camera.

If you already use a Micro Four Thirds system and have lenses that you have invested in, then they will carry right over to the BMPCC4K. This makes it an ideal upgrade path for Panasonic GH5 or Panasonic GH4 shooters that are ready to take the next step up in video quality.

Canon 5D shooters can also step up to the next level and carry over their existing lenses by considering the BMPCC6K with its Canon EF lens mount. If you are a Canon shooter that wants the video power of 4K 60P

RAW video then it makes a lot of sense to jump over to the BMPCC6K.

If you want the best image quality and most latitude in editing (most exposure/color correction, and grading) and you are on a tight budget, choose the BMPCC. The perfect tool for the ultimate video enthusiast without an extra \$20,000 laying around.

Pros

Best video quality from a handheld camera

ProRes for easiest results

RAW video for maximum editing range

Outstanding low and natural light

performance

Super affordable compared to other cinema cameras

Micro Four Thirds system maintains affordability and portability

Includes DaVinci Resolve Studio edition

Cons

Complicated workflow to make the most of RAW video

No in-body image stabilization

Slow autofocus and no continuous AF

Produces very large file sizes

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