

MASTER GUIDE TO RIGGING THE BLACKMAGIC DESIGN CINEMA CAMERA

By Sareesh Sudhakaran



This ebook is an update of the online version found here:

<http://wolfcrow.com/blog/master-guide-to-rigging-a-blackmagic-design-cinema-camera-part-1/>

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Chapter 1

Introduction

This guide outlines a road map on how to plan, assemble and build your own personal Blackmagic Design Cinema Camera (henceforth BMCC) rig. If you don't know what a rig is, fear not. All will be explained.

Who is this guide for?

This guide is written for the absolute novice. Everyone has to start somewhere. I have assumed that you are new to rigging and videography.

Those with experience, including thorough professionals, are also welcome to read this guide. It could be used as a checklist of things to go through for your own setups. Maybe I've missed out on something, and I will be grateful for your valuable feedback.

Warning and Disclaimer:

This guide is only intended to be an overview of my experiences in a nutshell, and should

not be seen as an encyclopedia of every possibility under the sun. I haven't used every system out there, nor have I experience with every device in this guide.

Many of my recommendations and suggestions are from personal experience. However, just because I recommend one product does not mean another doesn't exist that might fulfill the same function equally well, or even better. We all hope for things to improve, and it isn't necessary that your thoughts will sync with mine. The last thing I want is for this guide to be seen as an item-by-item shopping list of what to purchase.

Read, understand, think for yourself, take advice from other professionals and peers for a more holistic view, and accept responsibility for your actions and choices.

Do I make mistakes? All the time. Luckily, I have readers who point out my errors, which allows me the opportunity to correct them. If you do find errors in this guide – and I'm absolutely certain there are plenty – please bring them to my notice. I'll try to correct

them as soon as I can, so the next person reading it will be that much better informed.

I don't guarantee correct, accurate or relevant information. Refer to the documents provided by the manufacturer for the correct specifications and settings.

What's the best way to use this guide?

The order in which I've laid out this guide is what works for me. I feel my simple methodology will get you to your goal the fastest. If you are new, start at the beginning and work your way in the order this guide is presented in.

What is a Rig?

Buying a camera is not really buying just a camera. What you're really buying is a collection of tools.

Each tool is designed to fulfill a specific function. No matter how good the tool looks or performs on its own, it is useless unless it can work well with everything else.

This process of customization, the bringing together of tools to fulfill a common purpose, is called Rigging. This synergy of tools is a Rig.

Why is it called a rig, like an oil rig, for example? Because it is meant to be temporary. It is understood that a rig might need to change its components, shape, orientation or function; and must be ready to do so when required.

An improperly designed or assembled rig can make life hell for all those using it. The biggest mistake filmmakers make when designing a rig is giving too much importance to specific tools, while losing the big picture.

Unfortunately in today's world, rigging has become the norm. A filmmaker is expected to know how to put a rig together, as if there weren't enough headaches already.

The BMCC follows this paradigm. So let's not waste any more time, then. Let's get rigging.

Chapter 2

Ergonomics and Connections



There's no doubt about it – the BMCC has been a marketing success. Yes, there are other companies claiming to provide RAW 2K for cheap, but none with the stature of a proven company like Blackmagic Design.

First, let's understand whom this camera was designed for.

Here it is, in the manufacturer's own words:

*...it's perfect for independent film,
television commercials and episodic
television production...*

*...it's perfect for displacing video-only
cameras for work such as sporting events,
weddings, music videos and more!...*

*...Building one of the finest cameras in the
world requires attention to every detail...*

*...Every aspect of the image path has been
totally optimized for quality, so this means
you always get the quality you need for
the most demanding work...*

Source:

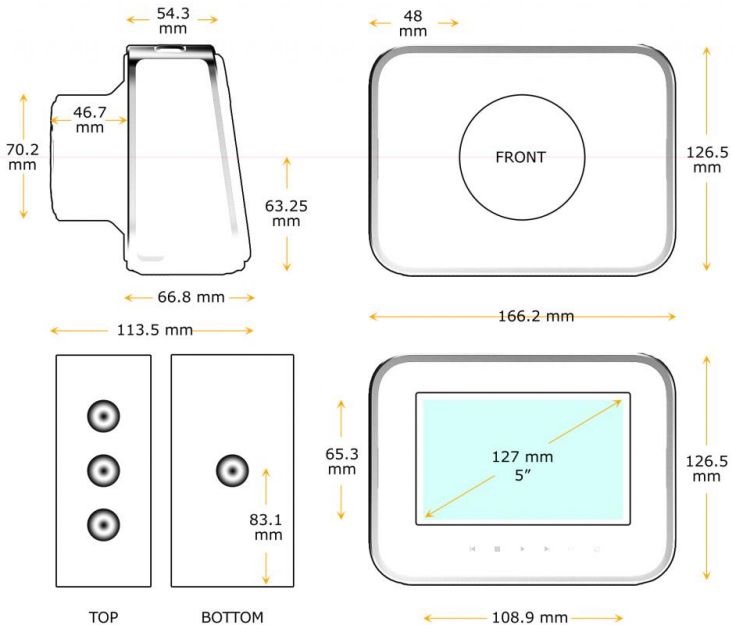
<http://www.blackmagicdesign.com/products/blackmagiccinemacamera/> (2012)

Ergonomics, dimensions and weight

The BMCC technical specifications page can be found [here](#).

The following image gives the dimensions of the BMCC. These are very rough estimates I 'reverse engineered' when information was scarce. Guess what? I was right!

Important: For exact measurements either ask Blackmagic Design (BMD from here on) or measure yourself.



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Note: The MFT version is slightly 'thinner' because it has a smaller mount.

The BMCC is by design a front-heavy camera. If you flicked it forwards it will

topple over. If you flicked it backwards, it most likely won't, unless the force is great.

I imagine the center of gravity to be slightly below the mid-point of the lens mount, which is okay for light lenses but not good enough for heavy lenses. With heavy lenses the height will make it easier to topple over. There is nothing new here, as a similar design is found in most other cameras and DSLRs.

To learn how this form factor affects ergonomics, refer to the [Ergonomics chapter](#) of the Comprehensive Guide to Rigging ANY Camera.

The camera chassis is machined aluminum. It has rubber front and back finishes for an easier grip – if you were inclined to hold it like a 7" tablet.

Connectors and Buttons

I actually like the fact that all of the BMCC's connectors are on one side – except I feel it's on the wrong side for shoulder-mounted

rigs. Why would I want all the cables to be on my face on a shoulder rig?



The BMCC has the following connectors:

- Remote – 2.5mm LANC for control
- Headphones – 3.5mm stereo
- Audio In – two 1/4" jacks
- SDI out – HD-SDI SMPTE 292M 10-bit 4:2:2 (maximum 30fps, 4 channel 24-bit 48 KHz audio)

- Thunderbolt – RAW video and audio capture
- USB 2.0 – mini B (only for firmware updates and configuration)
- Power connector (12V to 30V)

For some crazy reason the front-side record button is depressed/flushed so that you can have a great time feeling around for it on a shoulder rig. Luckily, there's one on the back in the opposite corner so you can twist your other hand like a pretzel while trying not to drop your camera.



The buttons on the BMCC are:

- Record – both front and back
- Iris – for lens iris control
- Focus – with peaking
- Rewind
- Stop
- Play
- Forward
- Menu
- Power

One must desperately hope their touch screen doesn't give out. I can't imagine the problems I'd face not being able to read the menu in bright sunlight – so I'm hoping someone comes up with a remote control interface. Fingers crossed.

The BMCC ships with a detachable sun shield, a camera strap, a turret dust cap and a 12V AC adapter (100-240V for all countries). I can't imagine many people lugging the camera rig around their neck.

If you're thinking: Why not? Doesn't it replicate the behavior of a DSLR? This is when I must ask you to reread BMD's words

above on what projects their camera is intended for. Their competition is the Arri Alexa, no less.

Inside the camera, in true Apple style, is an integrated lithium-ion polymer rechargeable battery that will give 90 minutes of life (BMD has not specified whether this is standby time or recording time). It takes 2 hours to charge, so unless you are only shooting for an hour every day, you'll need additional batteries. Imagine what will happen if your battery dies out a few years from now – how will that affect the resale value of your camera?

Blackmagic design also sells a separate Handle which I think should be shipped free with the camera.



In real world use, if you are using both hands to hold the camera via the Handle, what will you use to operate it – your nose?

I don't know about you, but I find it insulting that a camera manufacturer thinks a sun shade makes a camera studio-worthy, and adding handle-bars somehow makes it more rugged.

Once you've decided to buy the BMCC, the first question you will ask is: Which model should I buy, the EF or the MTF? Let's get on with it.

Chapter 3

Lenses and Accessories

The BMCC has a sensor size of 15.81mm x 8.88mm, which means the image circle is about 18.13mm. Compared to full frame 35mm, this gives us a horizontal crop factor of 2.28.

To know how the BMCC sensor stacks up against other cameras, and why I prefer the horizontal crop factor, read the [chapter on Lenses](#) from the Comprehensive Guide to Rigging Any Camera

The camera has a pixel pitch of 6.5µm, which means you'll need a lens that resolves better than 50 lp/mm to make full use of the 2432 x 1366 resolution. A lens that can out-resolve this is a fine lens indeed.

The BMCC has two mount options:

- A Canon EF mount with electronic iris control, (Flange distance 44mm)
- A passive MTF mount (Flange distance 19.25mm)

Which one should you buy?

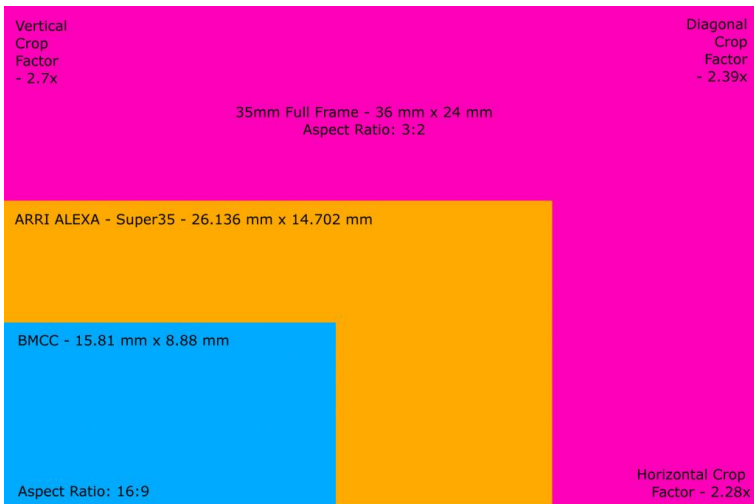
You know there's no one answer to this question, right? If you've invested in Canon or MTF glass, the choice is simpler.

But what if you're just starting out? I say buy the MTF mount. Here are my reasons:

1. The MTF mount accepts EF lenses. The reverse doesn't work.
2. The ability to collect lens data is cool for photographers, but if you're a filmmaker you can get someone to note down these things.
3. The lenses for the MTF mount are smaller and lighter, which makes rigging a lot easier.
4. The lenses for MFT tend to go a stop faster at the wider end.
5. Finally, the high-end lenses for the MTF system are cheaper than their counterparts in the EF world. Only a few EF lenses that are not L-series will out-resolve the sensor, the rest just aren't good enough.

Note: The EF mount version can also take Canon EF-S lenses, as confirmed by John Brawley [here](#).

Obviously, you can mount third-party lenses, too, like Nikon or Leica R glass.



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As you can see, the sensor is tiny when compared to Super35, and you won't get the same DOF characteristics.

You might find a lot of people complaining about BMD's decision to go with the EF

mount for such a small sensor. The widest non-distorted lens for the EF mount is the [Sigma 8-16mm f/4.5-5.6 DC HSM FLD AF](#), which at the wide end is about 19 mm in a 35mm equivalent AOV.

The thing is, even regular B4 bayonet lenses or C-mount lenses go only as wide as about 8 mm on average, and the really wide ones (4 to 5 mm or so) are so expensive one is better off shooting with a Red Epic. Also don't forget that the electronics on these lenses might not work as required, and a good lens mount adapter, like [this one](#) from MTF, isn't cheap either.

The 'problem' is not the mount, but the sensor.

Lens data aside, the other advantage of the EF mount is that you don't have to worry too much about corner distortion or 'vignetting', since only the center portion of the image will be used.

For better or for worse, you've selected your mount type. It's time to get your lenses.

A few notes before we start:

Where two prime lenses with the same focal lengths are mentioned, the more expensive one is better for follow focus systems.

When I say 35mm equivalent, I mean 35mm full frame equivalent, and not Super35 or APS-C equivalent – unless otherwise mentioned. This value is mentioned in brackets along with each lens.

The BMCC sensor is too big for C-mount, Super 16mm, 16mm, 2/3" CCD, 1/2" CCD and 1/3" CCD lenses – most of these lenses will vignette (have black borders). You might find a 'freak' lens that has a large enough image circle but I'd say that's a long shot.

Having said that, by using Super 16 lenses, you could crop the image to a 2K or 1080p format. I will not be covering this 'workaround' but the possibility exists nonetheless, and there are videos out there like [this one](#) that shows you how.

Lenses for the EF Mount



Primes

Ultrawide	Sunex 5.6mm f/5.6 Fisheye with Adapter (13mm) <i>Will need 'fixing' in post</i>
Wide	Zeiss Distagon T* 15mm f/2.8 ZE (35mm)
Medium	Zeiss 21mm f/2.8 Distagon T* ZE (50mm) Rokinon 24mm f/1.4 (55mm) Rokinon 35mm f/1.4 (80mm) Zeiss 25mm f/2 Distagon T* ZE (58mm) Zeiss 35mm f/2 Distagon

	T* ZE (80mm) Zeiss CP.2 Primes
Telephoto	Zeiss ZE Planar T* 50mm f/1.4 (115mm) Zeiss 85mm f/1.4 Planar T* ZE (196mm) Zeiss CP.2 Primes
Super Telephoto	Canon EF 135mm f/2 L USM (310mm) Canon Super Telephoto L Series Primes

Zooms

Wide	Sigma 8-16mm f/4.5-5.6 DC HSM FLD AF (18-37mm) Tokina 11-16mm f/2.8 (25-37mm)
Medium	Tamron AF 17-50mm F/2.8 XR Di-II LD SP (39-115mm) Canon EF 16-35mm f/2.8L II USM (37-80mm)
Telephoto	Canon EF 24-70mm f/2.8L USM (55-161mm) Canon EF 70-200mm f/2.8L IS II USM (161-460mm)

You might want to know why I haven't mentioned Nikon or Leica R glass for the BMCC. As far as I know, the performance differences of 35mm SLR lenses are only visible when used with sensors that demand perfection across the entire image circle. Most of these differences vanish with sensors like the one BMCC has, which only challenges the center portion of the circle – the strongest part of most high-end lenses.

Lenses for the MTF Mount

Primes

Ultrawide	Sunex 5.6mm f/5.6 Fisheye with Adapter (13mm) Rokinon 7.5mm f/3.5 UMC Fisheye (17mm) <i>Both will need 'fixing' in post</i>
Wide	SLR Magic HyperPrime Cine 12mm T/1.6 (28mm)
Medium	Zeiss Distagon T* 15mm f/2.8 ZE with adapter (35mm)

	Voigtlander Nokton 17.5mm f/0.95 (40mm) Voigtlander 25mm Nokton f/0.95 (58mm) Voigtlander Ultron 35mm f/1.7 (80mm) Zeiss CP.2 Primes
Telephoto	SLR Magic Noktor 50mm f/0.95 (115mm) Leica M 90mm f/2.5 with adapter (200mm) Leica M 135mm f/3.4 with adapter (300mm)
Super Telephoto	Canon Super Telephoto L Series Primes with adapter

Zooms

Wide	Tokina 11-16mm f/2.8 with adapter (25-37mm)
Medium	Zeiss LWZ.2 15.5-45 T/2.6 (35-100mm) Panasonic 14-150mm f/3.5-5.6 OIS with adapter (32-350mm) Leica Tri-Elmar-M 16-18-

	21mm f/4 with adapter (37-41-50mm)
Telephoto	Vivitar series 1 70-210mm f/3.5 with adapter (160-480mm) – check for sharpness before buying Canon EF 70-200mm f/2.8L IS II USM with adapter (160-460mm)

Top of the line:

[Zeiss Custom 7-Lens Compact Prime CP.2 Set](#)

For those wanting the ultimate quality that can be used with professional follow-focus systems, I recommend Zeiss CP.2 Lenses.

The kit includes the 18mm f/3.6 T, 21mm/T2.9, 25mm/T2.9, 28mm/T2.1, 35mm/T2.1, 50mm/T2.1, and 85mm/T2.1.



These lenses come in rugged bodies that are custom-made for heavy duty film and video work. Once you've used them, there's no going back.

If you do plan on using Nikon or Leica R glass, you'll need adapters.

Lens Mount Adapters



For Leica R: [Fotodiox Adapter, Leica R Lens to Canon EOS](#)

For Nikon F-mount glass: [Fotodiox Adapter, Nikon Lens to Canon EOS](#)

For EF glass to MTF mount: [Pro Optic Lens Adapter](#)

FILTERS

I have written extensively about the important kinds of filters and how to select them in the [chapter on Filters](#) in the Comprehensive Guide to Rigging Any Camera.

Here are my suggestions for various filters. I

list both screw mounted (mainly 77mm filter size) and 4" x 4" matte box mounted filters.

UV Filters

There's no real harm in leaving a UV filter on your lens forever, as long as you remove it for cleaning once in a while. If you don't, the UV filter might get stuck onto the lens.

The [Tiffen 77mm UV Protection Filter](#) is a great all-rounder.

But the best is: [B+W 77mm UV Filter](#)

Polarizing Filters

There are two kinds of polarizing filters – Linear and Circular. Both of them do these things:

- Darken the sky
- Remove reflections from surfaces like water, mirrors, etc
- Take the gloss off shiny surfaces
- Increase color saturation

I'll keep it simple – stick to circular polarizers for the BMCC. They do everything linear polarizers do, and they are not hard on your camera's meter.

Here are my choices:

[B+W 77mm Kaesemann Circular Polarizer](#)

[Schneider Optics 4"x 4" True-Pol Circular Polarizer](#)

Neutral Density Filters

There are three broad classes:

- Fixed value ND filters
- Variable ND filters
- Split or Graduated ND filters

Fixed value ND filters offer the greatest precision, with the downside that you'll need many filters to cover all scenarios. Here's an example:

[Tiffen 77mm Neutral Density 0.9 Filter](#)

For Matte boxes, try: [Schneider Optics 4"x 4" ND 0.3, Neutral Density Filter](#)

For Variable ND filters I only recommend the best. You change the density by rotating the filter. Try: [Singh-Ray Vari-ND Variable Neutral Density Filter](#)

For Split or Graduated filters ND filters try:

[B+W 77mm Grad ND Filter](#)

For an ND filter on Matte boxes, try:

[Schneider Optics 4"x 4" Neutral Density ND 0.9, Soft Edge Graduated Filter](#)

Diffusion Filters

Like ND filters, diffusers have different 'powers', depending on the intensity of the effect you are after. E.g., The [Tiffen 77mm Glimmer Glass Filter](#) has numbers 1, 2, 3, etc – where 1 is the subtlest effect and it goes up from there. Test thoroughly before you use.

[Tiffen 77mm Glimmer Glass 3 Filter](#)

For Matte boxes, try:

[Tiffen 4×4 Gold Diffusion Special Effects \(FX\) Filter #1](#)

Filters obviously form an integral part of any videographer's or cinematographer's arsenal of tools. It's so much easier and cheaper to get certain effects on camera rather than in a color grading suite – and not to mention more artistically satisfying!

Lens Hoods

Lens hoods cut out flare.

A lot of the time, lens flare is hard to detect on a small LCD screen or viewfinder, and flare means a low contrast image. The touchscreen display on the BMCC will not make it easier!

Different focal lengths and camera lenses have different kinds of hoods. Stick to the one the manufacturer recommends.

Lens and Body Caps

There are two types: Front and Rear caps. You might be surprised how many people forget this while packing gear. Those who don't forget usually lose them! Make a habit of always storing lenses with their caps on either end and you should be okay.

The BMCC comes with a turret mount cap – but what if you lose it? I don't see BMD selling mount caps as a standalone item. Hopefully, these should fit:



Chapter 4

Matte Boxes and Follow Focus Systems

MATTE BOXES

A Matte box serves two major purposes:

- It cuts flare
- It helps mount filters



To know how to choose and rig matte boxes read the [chapter on Matte boxes](#) in the Comprehensive Guide to Rigging Any Camera.

Lens-mounted Matte boxes

For lightweight 'running-and-gunning'

Run-and-gun also means the system will take a lot of abuse, so going cheap isn't a good idea.

[Genus GL GWMC Wide Angle Matte Box](#)



[Genus GL GFFW French Flag Assembly](#)



If you know the filter size of your lens, you could use an adapter ring:

[Genus GL GAR77 77 mm Lens Adaptor Ring](#)

If you have lenses with varying filter thread sizes, you could also use nun's knickers – these are like bellows that can take any filter size 72mm and up:

[Genus GL GARD-NK Lens Adaptor Ring with -InchNuns Knickers](#)



Beware that nuns' knickers can't be used in a lens-mounted mode, so you'll need to buy the additional rod kit.

Rod Mounted Matte boxes

For 'heavyweight' filmmaking

Rod mounted matte boxes are too heavy to be left on the lens. Here are two great options:

[Chrosziel 450W Matte Box Kit](#) [Arri MMB-2 Matte Box kit](#)



The MMB-2 matte box has a 114mm filter size – which fits perfectly to a Zeiss CP.2 lens. If you're using 77mm or other filter sizes, you'll need adapters.

Matte boxes might look like complicated pieces of gear but there's nothing to them, really.

FOLLOW FOCUS

The [chapter on Follow Focus](#) systems in the Comprehensive Guide to Rigging Any Camera explains why we need follow focus

systems, and what one should look out for when buying one.

Here are my suggestions, from cheapest to best:

[Digital Shoulder Rig and Follow Focus](#)



[Genus G-SFOC Superior Follow Focus System](#)



Arri MFF-2 Follow focus system



The MFF-2 has interchangeable focus knobs and is available in two different bases: a cine style base and an HD version that utilizes a 1:1 gear ratio for lenses with a shorter throw (such as EF lenses).

Remember, matte boxes and follow focus systems are long term investments, just like your lens.

Chapter 5

External Monitors, Viewfinders, Recorders and Data Management



The built-in LCD monitor on the BMCC is a 5" monitor with a resolution of 800 x 480. It has a 1.67 aspect ratio at roughly 187 ppi. It's nowhere near the resolution of an HD monitor or DSLR LCD, but it's not bad either.

Since BMD has announced plans to have the waveform and vectorscopes in camera, along with the zebra and focus peaking features, I

think for the cash-strapped filmmaker a 5" LCD monitor is a god-send.

Furthermore, the BMCC records RAW, which does not have a color space or chroma sub-sampling applied to it. One can definitely expect a few viewing LUTs down the line.

All said and done, I don't think the touchscreen monitor can be used as a serious tool for color evaluation.

To know whether or not you need an external monitor, and how to find the right one, read the [chapter on External Monitors](#) in the Comprehensive Guide to Rigging Any Camera.

The BMCC does not have an HDMI port. It has two ports for monitoring:

- HD-SDI SMPTE 292M
- Thunderbolt 10 Gbps (with option for 20 Gbps)

USING HD-SDI

The signal characteristics for the HD-SDI feed are:

- 10 bit 4:2:2
- 1080p30 maximum frame rate at 1.485 Gbps
- Rec. 709 color space with two LUTs/gamma called Video and Film Dynamic Range
- Uncompressed video SMPTE 292M
- 4 channel audio at 24-bit 48KHz

This is the most widely used standard for professional monitoring. As you may have noticed, it cannot display the full 12-bit 2.5K RAW image – but this is applicable to all cameras that shoot RAW, so it isn't an issue.

This signal is ideally suited for creating real-time proxies for faster editing.

To create quick proxies for the BMCC, try the:

[Blackmagic Design UltraStudio Mini Recorder](#)



The recorder accepts SDI in and delivers a compressed video via Thunderbolt to a laptop.

If you want a more robust solution on the field, try the:

[Blackmagic Design H.264 Pro Recorder](#)



Excellent monitoring and focusing

[Marshall V-LCD651STX-3GSDI-SL 6.5"](#)



This monitor accepts the HD-SDI feed directly and has a resolution of 1024 x 768 with a brightness of 650 nits.

Don't forget LCD hoods. I recommend getting them from the same manufacturer for a perfect fit: [Marshall V-H50 Sun Hood](#)

Critical monitoring of color

I prefer: [24" Professional Studio Monitor With HDSDI](#)



With monitors like these, you'll also need long cables that are of excellent quality. You can't afford signal loss over 10 to 50 feet.

[Canare BNC to BNC \(SDI\) 25 Foot Cable](#)



If you're planning to use more than one monitor on set, you'll need decent splitters:

[SDI Splitter 1:4](#)



Good monitors have hardware calibration installed, but you can never be too safe. You'll need a third-party calibration tool like this one:

[ColorMunki Monitor, Printer & Projector Profiler](#)



Large external monitors need hoods and accessories too, so make sure you understand what you're getting into before committing.

USING THUNDERBOLT

The Thunderbolt interface is capable of 10 Gbps and 20 Gbps. What can you do with it? You can:

- Record video
- Monitor video

Recording video

The BMCC comes with Media Express 3, a free software that runs on Windows 7, Mac OSX and Linux.



Media Express supports real-time capture and playback of 2.5K RAW, metadata, thumbnail view and clip bins, etc. You can

also use Media Express to capture uncompressed HD, Prores and DNxHD.

If you want to record quick proxies via the Thunderbolt port, try the [BMD Mini Monitor](#).

Ideally, if you need a laptop on set, it's hard not to recommend a Mac Pro:

[Apple MacBook Pro 13.3-Inch Laptop](#)



PC users will need a thunderbolt-enabled laptop. I have been using Acer for years and will definitely recommend an:

[Acer Aspire S5 13.3-Inch Ultrabook](#)



Don't forget the expensive thunderbolt cables:



So, what exactly will you be recording? As we've seen earlier, if you're recording 2.5K, the data rate is 150 MB/s at best. If you're recording Prores or DNxHD, the data rate is 220 Mbps at best. Let's look at these scenarios.

For a typical 2 hour movie project, if the shooting ratio is 10:1, you'll need 20 hours of footage.

@2.5K, this is about 11 TB of data. Assuming double for backup, you'll need at least two of these:

[Western Digital 12 TB WD Sentinel DX4000](#)



@1080p compressed Prores or DNxHD, this is about 2 TB of data. Assuming double for backup, you'll need 4 TB, or at least two of these:

[Western Digital My Passport 2 TB USB 3.0 Portable Hard Drive](#)



Obviously different productions have different requirements, so my suggestions are to give you an idea of the kind of stuff you'll be lugging around to fulfill your filmmaking dream. RAW video is not child's play.

Monitoring video

The BMCC includes Ultrascope, a free software that includes every tool you'll possibly need to monitor your video for quality and errors.



The cool thing about this is that it uses the same thunderbolt port used by Media Express, and you can keep both programs open. This is the advantage of thunderbolt – you can read two 2.5 streams simultaneously. Whether or not BMCC works this way is another matter altogether.

Finally, you can also use the Thunderbolt port to monitor via an SDI or HDMI monitor, using the [Blackmagic Design UltraStudio Mini Monitor](#).

What you should realize is that using the thunderbolt port also means getting a laptop or adapter – which is not the way many would like to operate on set. BMD has done extremely well by putting in an HD-SDI port.

All said and done, this camera might prove to be the cheapest broadcast quality camera yet once it hits full production.

VIEWFINDERS

As we have learnt in the [chapter on Viewfinders](#) from the Comprehensive Guide to Rigging Any Camera, viewfinders come in two types: optical and electronic.

Unfortunately, using an optical viewfinder means blocking the LCD touch screen, and losing quite a bit of functionality. I will definitely not recommend it.

What I will strongly recommend instead, is an electronic viewfinder (EVF).

Electronic Viewfinder



For an excellent viewfinder, try the [**Cineroid EVF Metal Viewfinder**](#).

The Cineroid Metal version has options for HD-SDI, HDMI or even HD-SDI/HDMI loop-throughs, which is really handy when you have a camera like the BMCC with only one BNC port.

For even better HD experience, try the [**Cineroid Pro EVF4RVW**](#) with Retina Display (350 ppi).

If you prefer an HDMI solution (no reason really to go HDMI), try the: [Zacuto Z-Finder EVF Pro 3.2 inch](#)



The Zacuto EVF Pro has an HDMI connector, so you'll need an SDI to HDMI converter, like this one: [Blackmagic Design Mini Converter SDI to HDMI](#)

Don't forget HDMI cables: [Mediabridge High Speed HDMI Cable with Ethernet](#)

Recording Media - SSDs



On one side of the BMCC is a slot for one 2.5" Mac OS Extended format (HFS+) SSD drive. Windows users will need third party apps to create or read mac-formatted drives that can be used on this camera. Yes, the BMCC is an Apple-friendly camera.

The BMCC supports two recording formats:

2.5K (2432 x 1366) 12-bit Cinema DNG RAW at 23.98p, 24p, 25p, 29.97p, 30p.

Data Rate is 5 MB/frame

@24fps, data rate is 120 MB/s (about 1 Gbps)

@30fps, data rate is 150 MB/s (about 1.2 Gbps)

1920x1080 10-bit 4:2:2 Prores HQ (or 422) or DNxHD 220 at 23.98p, 24p, 25p, 29.97p, 30p.

Data rate is less than 1 MB/frame

@24fps, data rate is less than 24 MB/s (192 Mbps)

@30fps, data rate is less than 30 MB/s (240 Mbps)

The following SSDs are recommended for CinemaDNG video capture*:

[Crucial Technology 256 GB C300 Series](#)

[Crucial 512 GB M4](#) (firmware 009)

[Kingston 64GB SSDNow V+100](#)

[\(SVP100S2/64G\)](#)

[Kingston 128 GB SSDNow V+100](#)

[Kingston SSDNow V+200 240GB](#)

[Kingston HyperX 240GB](#)

[Sandisk Extreme 480GB](#)

**This list is as per the manual, January 2013. On the support page, the following SSDs are also listed, but might not work:*

[OCZ Technology 240 GB Vertex 3](#)

[OCZ 480GB Vertex 3](#)

[Samsung 830 – Series 512 GB](#)

[SanDisk Extreme SSD 480 GB](#)

Once the shipping problems are ironed out, a full list should be updated on the site. Don't forget to check actual real-world benchmarks to see if your preferred drive can sustain 150 MB/s minimum. BMD only recommends SATA III 6 Gbps drives.

The following SSDs are recommended for compressed video capture:

[Crucial 256 GB M4](#)

[OCZ Technology 240GB Agility](#)

[SanDisk Extreme SSD 120 GB](#)

Data Management

You now know what equipment is required to make the BMCC run on the field. A full workflow is beyond the scope of this guide. However, here is the general way in which BMD expects you to work with RAW files:

- Record RAW CinemaDNG to SSDs.
- Copy files to a computer using a 2.5" SSD dock like [this one](#). You could also use a thunderbolt or eSata dock.
- If you're using a Windows-based computer, you'll need software that can read a Mac-formatted drive, like the [Mediafour Macdrive](#).
- Once the footage is in, open Resolve 9, which ships free with the BMCC, and import footage. The naming conventions are explained in detail in the BMCC manual, found here:

http://www.blackmagicdesign.com/media/4720483/Cinema_Camera_Manual.pdf

- Apply a basic grade in Resolve for the clips you want to work with and transcode those into a proxy format – either Prores, DNxHD, H.264, whatever you want.
- Import files into an NLE and edit.
- Once your edit is locked, export an XML or AAF file from the NLE. Your source footage (RAW files) and proxies (from Resolve) should remain in the locations they were in at the beginning. If this changes, you might find yourself in a world of pain.
- Import the XML or AAF file into Resolve and conform the edit to the original RAW files. You can also use the LUTs you have set in camera into Resolve.
- Perform your final grade and export your master.

I recommend recording proxies on set. Once the camera becomes established, we might find major NLEs supporting native DNG editing. Until then, you're stuck with one additional transcode.

Chapter 6

Audio

The BMCC has an in-built mono microphone and mono speaker – both of which are perfect for unimportant home movies.

It has two 1/4" TRS jacks for professional balanced analog audio, switchable between mic and line levels. It has one 3.5mm TRS jack for headphones. Here's what they look like:



The right-most is the 1/4" jack, and the two in the middle are 3.5mm jacks.

What's a 'balanced analog audio' signal?

The 1/4" TRS has two conductors, called the *tip* and the *ring*. The pyramid-shaped tip is the tip, and the space between the two black rings (insulators) is the ring. In an unbalanced system, the tip is the left channel and the ring is the right channel – which means each connector is capable of stereo sound.

However, on a balanced signal, the 1/4" TRS connector only gives mono sound, which is why BMCC has two of them.

1/4" TRS connectors are smaller than XLR connectors, so it is clear why BMD decided to use them instead. The BMCC is capable of 4 channel 24-bit 48 Khz audio, via SDI.

What are the disadvantages of 1/4" TRS connectors?

From Wikipedia:

The socket grounds the plug tip and ring when inserting or pulling out the plug. This causes bursts of hum, cracks and pops and may stress some outputs as they will be short circuited briefly, or longer if the plug is left half in.

So it is critical that the connectors aren't touched during operation – which brings us to the second disadvantage: There is no 'lock' as in XLR connectors. It's easy for someone to step on the microphone cable and ruin a take. The last disadvantage is that TRS connectors cannot give phantom power (which means supply power to) to the microphone – so you're going to have to depend on batteries.

Even so, if you're willing to live with all the limitations of a balanced TRS system, one can't argue that there is any loss in quality due to it.

Assuming the BMCC records uncompressed Linear PCM 24-bit sampled at 48 KHz mono (x2 channels), the bit rate is approximately 2250 kbps total. This is perfectly fine for

situations where only two microphones are required.

Whatever levels and audio controls the BMCC has, they are not variable while recording. I don't think any audio professional would love to look at the 5" display and fight for screen time!

I've outlined my philosophy on audio in the [chapter on Audio Gear](#) in the Comprehensive Guide on Rigging Any Camera. I've also given three 'levels' of audio recording on set and explained why I prefer one over the other.

All the recommendations and suggestions I've made in that chapter hold true for the BMCC, so there's nothing much to add. One piece of gear that might come handy is an XLR to TRS adapter, like the: [Wooden Camera A-Box](#):



Chapter 7

POWER SUPPLIES

The BMCC comes with an in-built lithium-ion polymer rechargeable battery. It is rated to give 90 minutes, but BMCC haven't mentioned whether this is standby time or recording time. The integrated battery takes 2 hours to charge, so it should be clear to anyone with some production experience that an alternate source of power is mandatory.

What happens when this battery dies?

According to my discussion with [Joshua Helling from BMD](#), the battery will be replaced by BMD for about \$90, if it dies outside the warranty period.

AC Supply

I'd leave the internal battery as a backup. The package also includes a 12V AC Adapter for continuous power. If you're in an environment with easy access to an AC wall socket with reliable power (non-fluctuating),

this is perfect. If going this route, don't forget a surge protector:

[Belkin Mini Surge Protector Dual USB Charger](#)



Battery Supply

The BMCC has a DC port rated to take 12-30V, which is great. The camera itself is rated at 18 Watts. The higher the voltage of your battery, the lesser the ampere draw required.

Don't forget to read my philosophy on selecting and calculating battery sizes, and how to set up a reliable battery system. You'll find it in the [chapter on Power Supplies](#) in the Comprehensive Guide to Rigging Any Camera.

How much mAh does the BMCC need?

The BMCC will need 18 Wh to run for one hour. If your battery is 12V, you will need a battery with a rated capacity of 1,500 mAh per hour. If your battery is 30V, you'll only need 600 mAh per hour.

I always plan for each battery to run for 4 hours, with intermittent recording and standby time. Two batteries will last for 8 hours and I usually carry a third for backup as well as for those occasions when we have a longer day.

The simplest solution for the BMCC is currently made by [Switronix](#):



This supplies 4,800 mAh in total and can power three devices of 12 V each. On a rig it can take care of the camera, the external monitor and the electronic viewfinder. If the external monitor isn't required, it can take care of the camera, viewfinder and SDI-HDMI converter, and so on.

The other solution I recommend is by Anton Bauer, via their QRC-BMD gold-mount for the BMCC, using the [Dionic HC 91 Wh battery](#).

At 14.4V, this battery will give you about five hours.

The Marshall monitor and EVF has a total capacity of about 15 W at 12 V, which gives a combined ampere draw of 1,250 mA. Combined with the BMCC the current draw is about 2,500 mA. A 4,800 mAh battery will give us 2 hours of use. If you want 12 hours of use, you'll need 6 of the Switronix batteries.

Trying to go with cheaper batteries that advertise similar capacities as the more professional brands is not a good idea.

Cheap batteries are like balloons. When full they let out air in full steam, so to speak. As the air gets lesser, the force gets lesser as well. Similarly, a cheap battery might not give us a 12V continuous voltage throughout the ampere hour range.

For a full BMCC rig with an external monitor, zoom lenses, viewfinder and recorder, etc., I recommend the Anton Bauer solution.

Chapter 8

Putting the Rig Together

To learn how to lay out a rig, calculate the center of gravity, and find the ideal rig structure, read [Laying Out the Rig](#) in the Comprehensive Guide to Rigging Any Camera.

I also recommend you read [Baseplates, Bridge plates, Cheese plates and Rods](#) so you know how I select these components.

For what I've seen of the BMCC so far, I don't recommend a cage. First of all, a cage would block the side ports and SSD slot. Secondly, it can't offer any more support than the solid aluminum frame of the camera.

Still, if you feel compelled to buy one, try the [Wooden Camera Cage for the BMCC](#).

The camera has a 1/4"-20 UNC screw thread tripod mount with a locator pin at the bottom. This mount will also accept BSW

screws of a similar gauge without causing much pain.

For a tripod-mounted setup, you don't even need a baseplate – you can use the tripod head's quick release plate. However, you would still need to support the matte box and follow focus system. Is there a system that is robust and can do all of the above for a tripod-mounted setup? Let's look at some options:

Guerrilla Run and Gun Setup

On the top of the BMCC there are three 1/4"-20 UNC screw thread mounting points to attach or secure whatever suits your fancy.

Weight of the camera body is 1.7 kg. Weight of a typical SSD drive is less than 100g, so the total weight of the camera with one SSD drive is about 1.8 kg. Make no mistake, this camera is going to be heavier than the typical DSLR. *Note: The MTF version is lighter, at 1.5kg.*

In a guerrilla run and gun setup there's only one operator and no matte box or follow focus. The idea is to make the camera as small as possible. In any case, you'll need a top handle:

[DSLR Cage Top Handle](#)



If you're recording sound you'll also need a microphone holder. This option can also back up as a handle:

[Adorama Heavy Duty L-bracket with 2 Standard Flash Shoe Mounts](#)



Two of the above can take a microphone and an external monitor, and balance out the rig.

The BMCC needs additional battery power. I strongly suggest wearing a belt-system for such a rig:

[Bescor MM-9, 12-Volt 9 Ah Shoulder Battery Pack with Cigarette Socket Output](#)



Battery belts usually come with car cigarette or XLR connectors. You'll need adapters to connect it to your camera. Here's a very 'visible' option:

[Anton Bauer Gold Mount Battery Holder with Integral Belt Loops and Power Cable](#)



If you want to also mount the rig on a tripod, you'll need a baseplate (or the quick release plate of your tripod head):

[Camera Mounting Plate](#)



The baseplate will take 15mm 18" rods:
[iKan Pair of 15mm Rods 18"](#)

This weight goes on the back end: [Opteka CBW-2 Counterbalance Weight](#)



If you have a sound recorder or heavy battery kit these could sit on a cheese plate like this one:

[Cam Caddie Cheese Plate](#)



Or even an L-bracket like this one:

[Sunwayfoto Wide Base Universal L Plate](#)



Of course you can also mount the camera sandwich style – camera over sound recorder over battery pack over tripod head. Not a pretty sight, but doable. If you have a little more cash, and don't want the aggravation of designing your own rig, take a look at the next option.

Professional Run and Gun

A professional run and gun setup might use a matte box and follow focus system. Try this: [Zacuto Ultra lite BMC](#)



To add additional gear at the bottom, go Zacuto as well:

[Zacuto Z-DSLR-B DSLR Base Plate](#)



A fully fitted tripod rig will look something like this:



For whatever reason, if you want to buy it, here are the [handle bars provided by BMD](#):



Now that you know what to look for, you'll have a far easier time finding them.

Chapter 9

Monopods, Tripods and Sliders

MONOPODS

If you're a one-person crew in the trenches, you'll be thankful for every gram you can shed.

All said and done, I'd prefer at least a monopod over the 'DSLR grip' or the BMCC handle bar. A simple rig – camera, shade, holder and lens with a hood will come in under 4 kg (8.82 lbs).

There are a few things you could add to the basic leg to take it up a notch. I recommend Manfrotto: [Manfrotto 561BHDV-1 Fluid Video Monopod with Head](#)



This has a load capacity of 4 kg (8.82 lbs), can reach a maximum height of 78.74 inches (6.5 feet) and a minimum height of 30.12 inches (2.5 feet). It weighs 1.9 kg (4.21 lbs).

TRIPODS AND HEADS

Bare Setup

The tripod I recommend is: [Manfrotto 504HD+546BK Video Tripod Kit](#)



This head can handle up to 7.5 kg (16.3 lbs), and the tripod can take up to 20 kg (44 lbs). It gives a maximum height of 59 inches (5 feet).

Full Rig

A full rig with a heavy zoom lens and all the bells and whistles will weigh in between 5 to 10 kg (11 to 22 lbs).

If you're aiming for such a rig, you might as well aim for a tripod that can also handle a mini jib arm or slider. E.g., a Glidecam 200 is about 9kg (20 lbs) and can support a fully rigged BMCC setup. In this case, it might be a good idea to get a tripod that can take 18kgs (40 lbs) or more.

My favorite choice for that is: [Sachtler 18 S1 SL MCF, with Speed Lock CF HD Tripod](#)



You'll find cheaper solutions and more expensive ones. The important thing is to

fully realize *why* a tripod needs to be what it is. A good tripod will last a lifetime.

Good tripods extend up to a man's height. But they don't go to ground-level. For that we have a hi-hat, coming up next.

Hi Hat or Low Base

A Hi Hat or Low Base is a mini-tripod that can almost go to ground level. A fully rigged system already has a height of about a foot (12 inches) including the head, so to really be at ground level you'll have to dig.

I recommend: [Bogen Imaging Manfrotto 529B Hi Hat](#)



SLIDERS

A full rig screams for a proper dolly on rails. If you're on the basic rig without much weight, this is a great slider: [Glidetrack HD 39 inch \(1m\) Heavy Duty Slider](#)



Be careful of cheap sliders. If not machined well, they'll have tiny bumps that will show up such on your cherished footage. Cheap knock-offs also use poorly made alloys, and are usually thinner as well. They deform easily.

If you're really that desperate use a wheelchair and sandbags.

To know more about sliders, read the [chapter on Sliders and Dollies](#) in the Comprehensive Guide to Rigging Any Camera.

Chapter 10

Shoulder and Handheld Rigs

It might be a good idea to read the [chapter on Shoulder Rigs](#) first. In it, I've explained my distinction of rigs into classes, based on the lever principle.

Class-1 system design

This is the most preferred system for handheld videography. The idea is to aim for rigs that give you lots of choices to place your gear so as to balance loads. Here are my choices:

For a fully-loaded kit: [Zacuto Z-DDB Double Barrel](#)



My ultimate recommendation for best rig is the [Arri BMCC kit](#):



Take note that both rigs come with counterweights at the back. You could also extend rods to add battery packs for additional support.

If you're smart enough you can buy bits and pieces and make your own rig. If you know what you're doing, it might be fun. The cost benefit is definitely worth the effort, and you'll be gifted with a one-off rig that fits perfectly with your body-type and shooting workflow.

Class-2 system design

This is my least preferred system for handheld videography. However, due to low budgets, this is the type that is most used! Better to go cheap here, since you'll need the money later.

Here are my choices:

[Zacuto Z-DSR Striker](#)



A cheaper version: [DVTEC Multi Rig Pro Stabilizing System](#)

An even more cheap version: [ePhoto Premium DSLR Rig](#)

Class-3 system design

The “compromise” system. This is a complicated design that not many manufacturers get right. You obviously value your back, so I have only one choice here: [Glidecam X10/HD-4000 Kit](#)

What you’ve probably noticed is that good rigs cost money. They use great materials, have reliable locks, are extremely configurable with a lot of accessories, and are utterly dependable. It’s a small price to pay, really, if you’re serious about your work.

Chapter 11

Miscellaneous Rigs and Gear

Underwater Rig

At the time of this writing [Equinox](#) has announced an underwater rig for the BMCC. It is still in testing and I'm not clear how the touchscreen interface will work.

3D Stereoscapy Rig

While you would have to be desperate to shoot 3D without Genlock ability, it is theoretically possible. A 3D rig basically 'sits' on top of a solid handheld rig. Side by side, the inter-axial distance is about 6.5 inches.

To get closer, here is my preferred beamsplitter 3D rig:

Hurricane 3D Camera Rig



Unfortunately, there's no way to sync or Genlock two 2.5K raw images. The BMCC also has a LANC port, but just because you can start two cameras at the same time doesn't mean they have to be in sync.

LANC Controllers

LANC (or Local Application Control Bus System), is used to synchronize camcorders and cameras. The BMCC has a 2.5mm TRS (Phone jack) connector for start and stop recording, iris Control and focus control.

Not all LANC controllers are compatible with the BMCC. BMD currently recommends:

[Manfrotto MVR901EPLA Pan Bar Remote for LANC](#)



And the:

[Bebob LANC ZOE-DVXL Zoom Control](#)



Important: Always plug in your LANC controller before switching on the camera,

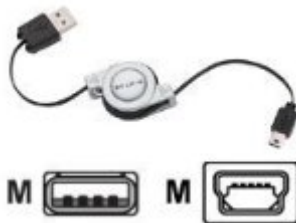
and switch off the camera before removing the pin.

To know more about LANC and remote controls, read [Making the Connections](#) from the Comprehensive Guide to Rigging Any Camera.

USB 2.0 Cable

The BMCC has a USB 2.0 mini B port for software updates and configuration. So you'll need a cable. Get one that isn't of a fixed length.

[Belkin USB-A/MINI5P-B Rtc Cable](#)



MISCELLANEOUS ACCESSORIES

Light meter

Here's a tough light meter that'll last you a lifetime: [Sekonic L-398A Light Meter](#)

White/Grey balance

A good grey and white balance card must be durable above all else. You're going to practically use it for every setup, and sometimes even between takes.

I recommend the [Lastolite LL LR1250 12-Inch Ezybalance Card \(Grey/White\)](#)

Color Checker

Fanatical about colors? You could be, if you're shooting product. Then you might want to invest in this: [X-Rite MSCCC ColorChecker Chart](#)

When used with a good monitor profiling kit this is as good as it gets.

Rain and Dust Cover

A handy cover to have, even if it doesn't rain: [Polaroid SLR Rain Cover Protector](#)

Cleaning Kit

Zeiss knows how to make lenses, and I'm sure they know best when it comes to cleaning them, too: [Zeiss Ikon Complete Optics Cleaning Kit](#)

Lifesavers

You could carry a tool kit for your rig. However, there are two absolute 'must-haves' that are also lifesavers. Always carry these:

[Energizer Weatheready Compact 3-LED Safety Flashlight](#)

And:

[Victorinox Swiss Army Champion Plus Pocket Knife](#)



Neck strap

Even though a strap comes free with your camera, there are more comfortable options. The BMCC with a zoom lens will weigh in at about 3 to 4 kg (6.6 to 8.8 lbs). For anyone who enjoys having dead weight hanging from their necks, a good neck strap is a must: [OP/TECH Pro Strap](#)



Wrist strap

The BMCC has rubber pads on the front and back for supposedly good grip, but I wouldn't trust that at all. A great wrist strap is a safety net as well as some support for fatigue.

[OP/TECH SLR Wrist Strap](#)



That's about it! We have designed, built and wrapped a full BMCC rig and it's ready for action.

You'll still need to put everything in bags and cases. I've already covered this extensively in the [chapter on Bags and Cases](#) in the Comprehensive Guide to Rigging Any Camera.

Thanks for Reading!

I hope this guide has given you the confidence to put together your own Blackmagic Design Cinema Camera rig.

How can you help wolfcrow?

As you can guess, this guide took a long time to write. Hey, I believe knowledge should be free, and information unambiguous. I hope you have felt its power.

If this guide has helped you please visit: <http://wolfcrow.com/blog/please-support-wolfcrow/> and buy me a cup of coffee, a case of beer or a fancy dinner.

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THE END