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Medium Format Cameras for Digital Photography

by Chris Lantz, Ph.D. • Western Illinois University

Introduction

Medium format camera systems can use a wide variety of replacement medium format digital backs. The digital backs fit on medium format cameras in place of the interchangeable film magazine they were designed for. Obsolete medium format cameras are compatible with older low cost tethered backs that are connected to a laptop with a Firewire cable. The Firewire backs can be used in the field with a small laptop.

Many medium format cameras have the advantage of having extensive lens systems. These lenses were originally designed for film-based photography but work well with digital backs. Medium format lenses provide a unique shallow depth of field look. German lenses such as Ziess and Schneider provide a high contrast sparkle to imagery for Rollei and Hasselblad medium format cameras. Japanese optics have a high resolution specification for Hasselblad-H, Mamiya, Fuji GX or Bronica.

Obsolete medium format camera systems compatible with older low-cost digital backs include Hasselblad 200/500/2000, Mamiya 645 Super/Pro/TL, Mamiya 645 AF/AFD Mamiya RZ-67, Mamiya RB-67, Bronica ETR/SQ/A/Ai, Rollei 6000, and Fuji 680 GX/II/III. These eight medium format brands have exceptional pricing on commonly used lenses such as the 50mm, 150mm or 250mm. Used lens choice with these cameras are far wider than with new medium format cameras. The camera, lenses and digital back options will be described as a guide in selecting medium format equipment in the following sections of this article.

Hasselblad 500 Series

The Hasselblad 500 series cameras include the 500C, 500CM, 503CX, 503CW, 500EL, 500ELM, 500ELX, 553ELX and 553ELD. The 500 series cameras use leaf shutter lenses with the C, CF, CFI and CB designation. Many older digital backs can be adapted to work with the 500 series cameras. There is a different three-pin trigger cable needed for digital backs for the EL series because these have built in motor winders like the Hasselblad’s used on the Moon (figure 1). The other cameras in this series use a more common mono/micro/mini plug to PC flash sync cable as a trigger cable. This later cable is easy to find because it was also used with strobe equipment. The Hasselblad 500 EL, ELM and ELX camera had an AC adaptor that is important because these cameras used expensive NiCad batteries. A 9V adaptor is available but 9V batteries can be expensive because they are depleted quickly in an EL. The newer 553ELX can be a better buy because it used longer lasting AA batteries, but no AC adaptor is available for this camera. Look for broken 553ELX’s because the spring battery contacts could get compressed if AA batteries are left in the camera and do not make connection. Bend these out for a low price. The 553ELD is not a good value because these cameras are the only option for some of the less reliable digital backs. This keeps prices high for those that need a replacement ELD camera. The accessory winder 500 series cameras such as the 503CW and 503 CXI are expensive because the winder has a stereo-mini-connector that later digital back adaptor kits worked with.

There is also a 2000 and newer 200 series of Hasselblad cameras that have an electronically controlled shutter in the camera that syncs with flash-only at 1/60th. The 200 and 2000 series cameras were designed primarily for F-series lenses. The 2000 and 200 series cameras also work with leaf shutter C-series lenses on the C-setting on their shutter speed dial. C-series lenses sync with flash at all.
speeds. The C-setting bypasses the focal plane shutter in the camera and uses the leaf shutter in a C-series lens. The 200 series cameras are expensive because some of their focal plane shutters were converted to work with digital backs and flash equipment. The 2000 series cameras are a good bargain because they do work with all Hasselblad 500 digital backs on the C-setting with C-series lenses but also work with the F-series lenses without flash ($200–350 for FC and FCW). Flash works with 2000 series cameras with F-series lenses with a PC sync cord splitter, but only on slow shutter speeds such as one second.

The Phase One Lightphase is a low cost 6 megapixel (MP) back. The Lightphase is often used with an external hot mirror filter on the lens. A hot mirror or infrared blocking filter is needed with some older backs because their pale blue filters on top of the sensor cloud up and need to be removed (figure 2). Sometimes white clouding can be removed with warm water and soap on the outside of the glass filter. If on the inside of the glass filter use lighter fluid to dissolve and remove it. This is residue that is caused by high temperatures on a rubber gasket between the blue glass and the sensor. This residue is not always removable when the glass is etched from long exposure to heat. Two rows of screws are removed on the Lightphase and the filter lifts off. There is a clear glass filter over the chip package.

All but the earliest Lightphase backs had this blue filter. The back with “BB00” starting off the serial number should be avoided unless it is $100 or less. Don’t assume that a Lightphase without the blue filter is an undesirable one. Check the serial number since the filters on later backs were removed and not cleaned. The earliest “BB00” backs need a Phase One “Firewire Repeater” accessory.

Get the Lightphase backs that start in “BB01, BB02 and BB03” since these don’t need a repeater. Later Lightphase backs work with the current version of Phase One Capture One software. Download the Capture One software and then install the DB or digital back version when given the option in the install software screen. Contact Phase One - they will need your back serial number for a free DB license.

Another digital back to use with the Hasselblad 500 series cameras is the Sinarback 43. The Sinarback 43 digital backs will be mentioned in each section of this paper because they are used with mount plates and adaptor cable kits that make them work with all the mentioned cameras. The Sinarback 43 is a Firewire back and is 11 MP. It works with freely downloadable Sinar CaptureShop software. The Sinarback 23 needs a fiber-optic PCI card and works best on CaptureShop 4 that is no longer downloadable on Sinar.ch (Lantz, 2014).

This is a good time to buy Hasselblad equipment because some are speculating that 120 medium format film will be discontinued before 35mm (Richards & Klutch, 2015). This speculation has been ongoing for ten years with new types of 120 film appearing in the marketplace.

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**Figure 2**

Before damaged IR cut filter removal on the left and after on the right.

**Figure 3**

The Hasselblad 150mm Sonnar telephoto lens with a shallow depth of field effect at f4.
format lens prices are lower for the common Hasselblad lenses and the availability of film does not affect digital back use. Common lenses include the 150mm Sonnar (figure 3), 250mm Sonnar (figure 4), and 50mm Distagon (figure 5). The 120mm S-Planar C-series lens is a good alternative normal lens because it is a macro optimized lens that needs an extension tube or bellows to work at macro focus ranges.

Many Hasselblad users could only afford one lens and the 80mm Planar was the standard lens bundled with the camera. The leaf shutters and focus mechanisms in the 80mm Planar Hasselblad lenses are worn out in many cases because the 500 series cameras were so reliable. The Hasselblad C-series lenses have mechanical Prontor leaf shutters that need to be periodically serviced like a mechanical wrist watch. The Prontor is a reliable German shutter that was picked to be used on the moon but it is mechanical and is less accurate than a well-made electronic shutter.

The advantage of the mechanical shutter is that it is more serviceable than electronic shutters. Some within-the-lens electronic shutters were meant to have a shorter life because they were meant to be replaced and not serviced. Neither electronic nor mechanical within-the-lens shutters for medium format cameras are available new. With medium format lenses, shutters are not as easily swappable between lenses as with a large format cameras.

**Hasselblad H1**

The Hasselblad H1 is the earliest in the current series of Hasselblad cameras leading up to H5. The H1 is an auto focus camera that uses Fuji-made H-series lenses. Lenses for the H1 fit on current series H5 cameras so used prices are high. H-series cameras wear out faster than 500 series Hasselblad cameras. This leaves surplus digital backs on the used market, sometimes for a lower price. The most affordable back for this camera is the Phase One H-101, with an 11 MP tethered back. The H1 camera does not work well with the H-101 back. Rechargeable lithium 123 batteries have a different voltage that makes the H-101 more reliable.

Another digital back that works with the H-series cameras and is sometimes available at a low price is the 22 MP Sinarback 54M. This back can be unreliable due to its gold contact connections, which work with interchangeable back adaptor plates (figure 6). The back will stop working with one adaptor plate and then work with a different plate for another camera. Switching to different plates such as the H-series plate can clear up the problem but results vary.

Hasselblad acquired the Danish digital back company Imacon. The last Imacon backs are the same as the earliest Hasselblad backs and can sell for a lower price. There is a less expensive Imacon model that has a screen that displays only histogram information. The newer Imacon backs that fit H-series cameras are also a good value because their IR filters cloud up. Look for condition issues that can help keep prices low for competitive bidding.
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Mamiya 645 Super, Pro or Pro TL

Many consider Mamiya cameras as film-only with no digital back possibilities. This is not true. Mamiya 645 Super, 645 Pro and 645 Pro TL can be used with Megavision and Sinarback 23/43 but these also work with Imacon Flexframe and Colorcrisp backs. These are not very robust cameras and break often, but are inexpensive. Think of them as disposable commodities and pay accordingly. Avoid Mamiya 645, 645J or 645E cameras because none have an interchangeable film magazine and can’t use digital backs. Recommended is Mamiya 645 lenses including the 80mm 1.9, 80mm f4 macro (figure 7), 120mm f4 macro, 150mm f5.6, and 300mm f5.6 (figure 8). Mamiya auto focus zooms covered in the next section have a slight edge in sharpness over some of the manual focus zooms but this may be caused by wear on older lenses.

The Megavision S3 or earlier digital back is not recommended. One S3 model only worked with Mac OS 8.6 and an older Macintosh G3 beige tower with a propriety PCI card of an old ROM revision. Later proprietary PCI cards and S3 backs worked with Mac OS 9.2.2 but not Mac OS 10. The original disk that came with the back is also necessary to get “blemish files.” The capture software is not available for download.

In the past Megavision sold their more recent Windows version of capture software. It has been a while since the old Macintosh version of their capture software has been available for free download. Old software is useful in testing hardware in order to determine if it is worth spending money on more current software. The Sinarback 43 Firewire back with a 645 Pro TL adaptor plate is recommended since the Sinar CaptureShop 6 software is available for free download. The 645 Pro TL Sinarback
plate is hard to find but easy to search for on on-line auction sites. It is sometimes available in other countries and is easy to ship to the US because mount plates and cables are small and not fragile.

**Mamiya 645 AF, and AFD**

The Mamiya 645 AF is Mamiya’s first auto focus medium format camera with its own series of auto focus lenses. Mamiya was acquired by the Danish company Phase One. The Mamiya 645 AFD was the first in a series of auto focus cameras made for digital backs. The later series cameras work with Mamiya’s own discontinued series of digital backs and other companies more recent digital back offerings. The author uses a Mamiya 645 AFD camera with the Sinarback 43 Firewire back. Mamiya manual focus lenses work on the auto focus Mamiya cameras and this increases the number of lenses available for the camera.

Most of the manual focus lenses are inexpensive and of good optical quality. Some of the more recent N-series manual focus lenses have the same glass as the older ultra low dispersion (ULD) marked auto focus versions. One example is the 210mm f/4 N manual focus lens that produces the same results as a 210mm f/4 ULD AF auto focus version. The authors favorite budget priced auto focus lenses are the 80mm f/2.8 AF, 105–210mm f/4.5 ULD AF and the 55–110mm f/4.5 AF. The auto focus on the longer telephotos and zoom lenses is turned on and off by pulling the focus ring in and out as well as the control on the camera. The auto focus gear in the camera is nylon and can strip, making the camera unreliable. Parts are still available for Mamiya AF cameras in many cases.

**Mamiya ZD**

The Mamiya ZD is the first generation of medium format camera that did not have a removable digital back and film magazine. This is a completely redesigned medium format camera body that used 22 MP medium format digital back electronics. Current medium format cameras of similar design have 50 MP sensors and are made by Leica and Pentax. This is a more popular camera design today for manufacturers because the end user needs to buy a completely new camera to upgrade to a newer imaging chip. Phase One still uses the older interchangeable digital back upgrade concept with their recent camera design. The old ZD uses standard Mamiya auto focus and manual focus lenses. The ZD uses lithium-ion video camera batteries.

**Mamiya RZ**

The Mamiya RZ67 is a bulky 6 x 7-cm medium format camera from the early 1980s. The sensor in a medium format back is closer to 645-cm than 6 x 7-cm. Viewfinder masks are used to provide the correct cropping for all digital backs that have a crop factor. Viewfinder masks can easily be drawn by hand but the original mask is nice to have if they come with the back. The RZ has an electronic shutter that syncs at all speeds. It made a good choice for the multi-shot Sinarback 43/23 or the Imacon Flexframe described in an upcoming section. Imacon or Sinarback’s can use multi-shot to increase resolution with multiple exposures. The RZ had limited tilt/shift camera movements possible with an expensive lens adaptor for the 110-250mm lens range. Recommended lenses are the 140mm f/4.5 L-A Macro, 180mm f/4.5 portrait focal length telephoto lens, 250mm f/4.5 telephoto, and 50mm f/4.5 wide-angle. A winder is necessary for a digital back if the back is controlled or tethered by Sinar CaptureShop or Phase One Capture-One. A back adaptor plate was available for Phase One Hasselblad backs to the RZ. A Sinarback plate was also available for the Sinarback 23/43 and 54M. Since the RZ was a popular camera many other newer digital backs had adaptors or models to fit the Mamiya RZ, and the later series RZ cameras.

**Mamiya RB67**

In the 1970’s the RB67 was an inexpensive camera with a mechanically controlled within-the-lens leaf shutter that synced at all speeds. Current camera bellows will show holes because of age and prices thus have dropped. This is good news because black tape can be used to patch holes. There was a rare Sinarback mount plate for the RB67. The Leaf C-Most digital back also had a RB-67 mount model. Leaf was an American company acquired by Phase One. Recommended RB67 lenses include the original 1970s Sekor-C lenses, such as the 90mm F3.8, 127mm 3.5, and 360mm 6.3. They are heavy but have robust build quality and are reasonably sharp even with a digital back at 6 MP.

**Bronica ETR**

The Bronica 645 ETR is another camera that is considered only a film-based camera. The Sinarback 23/43 had a mount plate for the Bronica ETR and Megavision made a S3 model for the ETR. There is also an adaptor to use Hasselblad digital backs on a Bronica ETR made by
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The later Bronica ETR PE lenses were made by Tamron. The ETRS Zoom Zenzanon-PE 45-90mm F4-5.6 is made by Tamron and is a good choice. The Bronica ETR wide-angles are small sharp lenses that are not overcorrected rectilinear lenses like Zeiss Distagon for Hasselblad. The ETR camera is worth getting just for a 40mm f4 and 50mm 2.8mm for this reason (figure 10). The ETR close-up auto-bellows is fully coupled with the electronic shutter in the lenses and is inexpensive. Bronica also made some accurate meter prisms that are now low in cost. All Bronica ETR lenses have accurate electronic leaf shutters that sync at all speeds. The 500mm f8 lens for ETR is a sharp and compact lens (figure 9). The common Bronica ETR lenses are often sold at low prices. This is especially true with the 75mm and 150mm focal length lenses.

The original ETR is a good choice, but the ETRS and ETRSi are often broken. The ETRSi had film TTL flash metering. Watch out for slipping shutter speed dials and electronic connection problems with the lenses, grips and prisms. The ETR has many gold contacts on the prism, lens, and bottom of the camera. These contacts can easily get out adjustment because of a loose screw, dirty connector, or broken mounting bracket. If a potential owner is willing to replace missing screws and parts from a donor camera than the ETR can be a good choice. The mount on Bronica ETR lenses must be protected from impact damage. They have small metal pressure pins that can easily be bent inwards and then the lens does not mount on the camera. Look for bargain lenses that do not mount because these pins can be adjusted if care is used not to break the pins off the lens mount. Bronica made the SQ, SQ-A, SQ-B, SQ-AM, and SQ-Ai series of 6 x 6-cm cameras for which a rare Sinarback adaptor was available. Avoid the SQ-AM because lenses can get locked on the camera if the camera does not power up. The SQ-Ai is necessary for tethered shooting with Sinar CaptureShop and the remote plug on its removable motor drive option. The Bronica GS-1 6 x 7-cm camera did not have a digital back adaptor solution available.

Rollei 6000

The Rollei 6000 is a camera system made by a recently bankrupt company in Germany and can be acquired on the used market for lower prices. Its biggest strength is

A 500mm focal length was used to take both photos. On the top a 500mm f8 Bronica lens was used on a Bronica ETR camera and on the bottom a 250mm Sonnar was used on a Hasselblad with a 2x Komura teleconverter. Both cameras used the same Sinarback with different adaptor plates attached.

A Sinarback 43, a Bronica 50mm F2.8 wide-angle lens and a Bronica ETR camera was used for this photo.
that high quality Ziess and Schneider lenses are available for it. The lenses had accurate electronic leaf shutters that sync at all speeds. Its biggest disadvantage is its NiCad batteries running the camera. One can rebuild battery packs with standard NiCad cells at a low price and the 6000 series Rollei cameras can be a bargain.

Rollei had an ill-fated partnership with Sinar to produce the Hy-6 camera and this camera used a lithium-ion battery. The Hy-6 was not as reliable as the 6000 series cameras and this probably caused both companies to seek bankruptcy protection. The Sinarback 23/43 had a Rollei 6000 adaptor plate and sync cord. This also works on the original Rollei SLX camera body.

Phase One had a rare Lightphase 6000 model as well. More current Phase One Rollei model backs also fit on the 6000 series. The oldest Rollei SLX lenses work on all models of the camera including the 6008 AF. Current manual focus lenses are needed to use metering functions in the higher end 6008/AF model.

The Imagon Flexframe 3030 and 4040 digital back system had a Rollei 6000 model. There is also an Imagon model of Rollei back that works only with the rare X-Act2 bellows camera but looks like a 6000 back. The Imagon Flexframe has a SCSI computer interface. It uses a Firewire cable as an interconnect cable between a SCSI control box and digital back but is not a Firewire back. The Imagon IR-cut filters can’t be cleaned but come off easily.

Imagon Flexframe has a multi-shot option in software. The slowest shutter speed possible with the Imagon is one-half second (not one second like the Lightphase backs). The control box has a laptop battery. Keep the battery in place to hold ROM memory in the control box and not as a portable solution. Don’t take out the removable laptop battery or unplug the control box for long periods once the back software is set up on the computer. This is because the volatile ROM data gets corrupted in the control box/software. Install the software on a new computer to get the back running again.

The 250mm f5.6 Sonnar 6000 series Rollei lens is multi-coated and compares well with the original Hasselblad 250mm C-series Sonnar. The 350mm Tele-Tessar Rollei lens is more compact than its Hasselblad counterpart (figure 11). The 150mm Sonnar has exceptionally smooth out-of-focus areas (figure 12). There are many more 80mm Planar f2.8 prime lenses for sale at lower prices for Rollei when compared to the Hasselblad 80mm (figure 13). This is possibly because there are more Rollei 6000 series cameras with dead NiCad batteries. For those who
can’t afford a Hasselblad 80mm, a Rollei can be a good second camera. The price of a complete Rollei 6000 camera and 80mm Planar is about the same as a Hasselblad 80mm.

Fuji 680 GX

The Fuji 680GX has front lens board rise and tilt controls like a large format camera. The original GX and GX II models seem to be the most reliable. The GX is a good way to sample Fujinon lenses at a low price when compared to the current price of H-series Hasselblad Fuji made lenses.

Aftermarket Fuji 680 GX to Hasselblad digital back adaptors are common. A cable release adaptor kit is needed for Phase One backs from Kapture Solutions. Fuji GX adaptors for Sinarback 23/43 are available. The GX is a good choice for a multi-shot Sinarback or Imacon (figure 14). Some photographers avoided cameras with mechanical shutters for multi-shot digital backs. This is because their slight inaccuracies can be a problem with multi-shot. Cameras used for multi-shot must have a cable controlled film transport motor and have the capability for mirror lock up. The Fuji GX has all these features.

Fujinon 680 GX lenses have electronic shutters that sync at all speeds. Some GX rear lens cells screw off for easy dusting of the inner elements. The author’s favorite lenses for the GX include the 300mm (figure 15) and the 65mm. The Fuji 680 GX had a Linhof large format lens board adaptor as an accessory (figure 16).
The Fuji 680 GX, a Sinarback 23 and a large format lens adaptor was used for this photo. A 90mm Componon-S enlarging lens mounted on a Linhof lensboard was used to take this photo.

Figure 16

Conclusion
Medium format cameras are available for a fraction of their original price and their lenses are sometimes available for a small fraction of the original cost. Low cost digital backs can be hard to find. If the buyer is persistent, not too picky about equipment condition, willing to buy from other countries, and tethered shooting is acceptable then digital backs with even rare camera mount plates can be productive options.

References

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