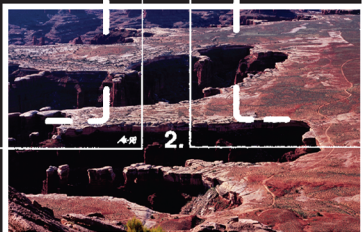
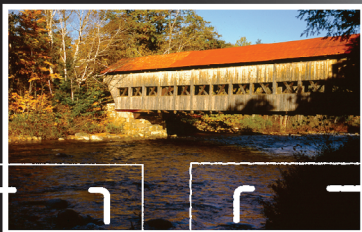


The Hasselblad Manual



Ernst Wildi

Seventh Edition

HASSELBLAD

A Focal Press Book



The Hasselblad Manual



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Seventh Edition



Ernst Wildi

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Preface



Since the first edition of *The Hasselblad Manual* was published more than 20 years ago, Hasselblad has taken giant steps into high-tech electronics and introduced updated and sophisticated digital cameras with the automation, the operating conveniences, and the programming possibilities that let you customize the camera operations to your personal photographic approach.

I have had the opportunity over many years to conduct lectures and workshops in the United States and in more than 50 other countries on five continents. This activity encouraged me to find better ways for operating and using Hasselblad equipment to produce effective images of the highest quality in any field of photography and these ideas, which apply to digital and film photography, are discussed in this seventh edition. *The Hasselblad Manual* can also serve as an instruction book for the major Hasselblad items that can be especially helpful to photographers purchasing equipment on the used camera market where the original instruction manual is often missing.

Because Hasselblad items are frequently changed and updated and some items are discontinued, do not consider the *Manual* as an updated Hasselblad catalog listing. The book describes the use and operation of all important Hasselblad items whether they are still manufactured today or not. You can obtain the latest catalog from a Hasselblad agent or by visiting the Hasselblad websites, www.hasselblad.com or www.hasselbladusa.com. Besides updated product specifications and a wealth of information that can be helpful in your photography, these websites also include a gallery of great Hasselblad photography that can be an inspiration to your own photographic efforts.

I would like to thank the photographers who enhanced the visual effectiveness of the *Manual* with examples of their photographic accomplishments. Some of these pictures were created on film, many others digitally, and if so, they were created in the camera with little or no manipulations in the computer. I mention this specifically because the purpose of *The Hasselblad Manual* is to show how Hasselblad cameras and lenses, not computers, can help create great photographic images. For the same reason, the captions for most photographs do not mention the recording media, film or digital, that was used to produce the image. I did this purposely to emphasize that the same camera techniques and approaches could have produced the images either digitally or on film. I hope that these photographs will inspire you simply for their visual effectiveness regardless of whether you work digitally or with film.

I also want to thank my friends and experts at Hasselblad for their wonderful help and cooperation in producing *The Hasselblad Manual* and for giving me permission to publish the diagrams from their instruction manuals and technical data sheets.

Ernst Wildi
September 2008

Hasselblad from Film to Digital



HISTORY OF THE HASSELBLAD CAMERA SYSTEM

In 1948, the Hasselblad 1600F was unveiled as the world's first $2\frac{1}{4}$ single-lens reflex (SLR) camera with focal plane shutter speeds up to $\frac{1}{1600}$ second, with interchangeable viewfinders, film magazines, and Kodak Ektar lenses. In 1952, the 1600F model was superseded by the 1000F, which was identical in design but had shutter speeds only up to $\frac{1}{1000}$ second.

The 1954 Photokina, held in Cologne, was used to introduce the Hasselblad Supreme Wide Angle camera, with a fixed 38mm $f/4.5$ Zeiss Biogon mounted in a Compur shutter. This camera was updated in 1959 and renamed the Superwide C, modified in 1980 to the SWCM, renamed the 903SWC in 1988, and renamed the 905SWC in 2001. The Superwide camera design was also available in a special version known as the MKWE for photogrammetric applications.

The next major step in the history of Hasselblad SLR cameras came in 1957, when the 500C model replaced the 1000F. The basic camera design and component interchangeability were kept, but in place of a focal plane shutter, a Compur shutter was built into each Carl Zeiss lens to allow electronic flash to be used at all shutter speeds up to $\frac{1}{500}$ second. The 500C was superseded by the 500CM in 1970, the 503CX in 1988, the 503CXi in 1994, and the current 503CW in 1997. A similar camera model appeared in 1989. Called Classic, this model became the 501C in 1994 and was changed to the 501CM in 1997.

The 500EL motor-driven camera model appeared in 1965 and became the 500ELM in 1970, the 500ELX in 1984, the 553ELX in 1988, and the 555ELD in 1998. The 500 EL design formed the basis for the 500EL Data camera, specially produced for NASA. On July 20, 1969, the 500EL Data camera became the first still camera to take pictures on the surface of the moon. A camera based on the NASA data camera design was available as the MK70 model, used mainly for photogrammetric applications.

In 1965, Hasselblad started the publication of the *Hasselblad Magazine*, later known as the *Forum*.

Hasselblad history continued with the introduction of major products as follows:

1977 — Schneider Variogon C 140–280mm zoom lens (changed to CF type in 1988). The 2000FC focal plane shutter camera and four F lenses without shutters, including a 50mm Distagon with floating lens element design. The 2000FC model was superseded in 1982 by the 2000FC/M, in 1984 by the 2000FCW, and in 1988 by the 2003FCW.

- 1982 — PCP 80 slide projector. C shutter lenses changed to CF types.
- 1985 — First 2× teleconverter made by Zeiss. Changed to a Hasselblad 2XE converter in 1994 and complemented with a 1.4XE converter in 1996.
- 1990 — PC Mutar with shift capability. Hasselblad ProFlash, replaced in 1996 by the D Flash 40.
- 1991 — 205TCC camera with TCC lenses and TCC film magazines. The 205TCC was renamed the 205FCC, and TCC lenses were renamed FE in 1995.
- 1994 — 203FE camera and 201F focal plane shutter camera without metering system.
- 1995 — FlexBody, complemented in 1997 by ArcBody with three special Rodenstock lenses.
- 1998 — 202FA camera. XPan dual format camera for 35 mm film with 45 and 90 mm lenses. 30 mm lens added in 1999. Was superseded in 2003 with XPan 11.
- 1999 — 300 mm *f*/2.8 lens and teleconverter.
- 2002 — Hasselblad H camera system. The H1 camera model was later updated to the H2, H2D and H3, H3D models with more professional integration for digital imaging.
- 2004 — To be competitive in the age of digital imaging, Victor Hasselblad AB combines with Imacon A/S in Denmark, a manufacturer of digital backs and scanners. The company name remains Hasselblad AB. A variety of digital backs and scanners are added to the product line carrying either the Imacon or the Hasselblad product name. Today all products for film photography or digital imaging carry the Hasselblad trade name.
- 2007 — Introduction of the H3D-II cameras with large 3-inch viewing screen, the HVM waist-level viewfinder, and 28mm HCD extreme wide angle lens for digital recording with H cameras. This was the first Hasselblad lens with Digital Apo Correction (DAC).
- 2008 — Introduction of the H3D IIMS multishot version of the H3D11-39 model. Also introduction of H2F camera, an H2 version for film photography and digital imaging, the global positioning system (GPS) for H3D cameras and the new Phocus software.

THE UPDATED CAMERA SYSTEM

The advent of electronic imaging changed the product line of all camera manufacturers including Hasselblad. Equipment that was popular for film recording was modified or discontinued and equipment designed specifically for digital recording was introduced.

A few examples from the streamlining process in the Hasselblad product line: The updated motor drive built into the H cameras and the availability of a detachable motor winder for the 503CW camera eliminated the need for the special motor-driven EL cameras. Since slanted verticals (in an architectural shot, for example) can now be straightened in after-image manipulations in a computer, the need for cameras with shift control like the FlexBody and ArcBody or shift lenses like the PC Mutar was reduced. While the XPan camera offers the simplest way of producing panoramic images, the need for a special panoramic camera is no longer essential because such images can be produced in the computer by stitching together a number of images taken with a regular digital camera. With most visual presentations done with computers, at least in the professional field, slide projectors are seldom used today. The PCP 80 is therefore no longer made. Wide angle lenses like the 28mm HCD with its 91 degree angle of view can now produce extreme wide angle pictures digitally where a photographer previously might have used a special wide angle camera like the Superwide.

While today's Hasselblad product line is reduced, it still includes the cameras, lenses, and accessories that are important and helpful for creating great images digitally or with film in any field of amateur or professional photography.

CONTENT IN THE NEW HASSELBLAD MANUAL

Since the Hasselblad Manual is recognized as a complete reference book for the use and operation of Hasselblad equipment, all the important items that have been part of the Hasselblad camera line are discussed in the manual regardless of whether they are still manufactured or have been discontinued. The manual does not mention specifically what items are still manufactured.

I feel that this is the correct approach. Many photographers all over the world still use equipment that is no longer made and because discontinued cameras, lenses, and accessories are often still available in camera stores and can certainly be found on the used camera market. Furthermore since Hasselblad introduced the first camera in 1947, the company has made many friends and loyal followers all over the world who not only enjoy taking pictures with Hasselblad cameras but love to study and talk about Hasselblad products. Photographers who still love to work with Hasselblad equipment that may be 10, 20, or even 30 years old like to be informed about the happenings within the Hasselblad organization and are simply proud of being part of the Hasselblad family. I feel it would be a letdown for all of these long time friends and loyal supporters of Hasselblad to see *The Hasselblad Manual* that only discusses digital imaging and only the digital cameras that are manufactured today.

Updating Discontinued Camera Models

The advent of digital imaging outdated and made completely obsolete most amateur and professional film cameras such as the very popular 35 mm SLR models. Not so with Hasselblad. Every SLR camera model made in the last 10, 20, or even 30 years for film photography, even if they are no longer manufactured today, become equally great tools for modern digital imaging by simply attaching a digital back instead of a film magazine. This applies to the popular 500 models and the other cameras in the V system such as the 200 models with the beautiful built-in exposure metering system as well as the cameras designed for special applications. For example, the Hasselblad FlexBody with its tilt capability equipped with a digital back is an excellent camera for digital tabletop, food, product, or other close-up photography when you need more depth of field than the camera lens can produce. The ArcBody, with its shift capability equipped with a digital back, is an updated and compact camera for digital interior or exterior architectural photography eliminating the need for carrying a large view camera on location. The PC Mutar mounted on a Hasselblad V system camera offers another great approach for digital architectural work or any other application where shift control results in a more effective image. Both the PC Mutar and the ArcBody often allow a good architectural image to be produced with straight verticals eliminating the need for time-consuming after manipulations.

THE HASSELBLAD CAMERA SYSTEMS

The Hasselblad camera system was reclassified in 2002 and the various camera models were grouped into three systems — the H, the V, and the X.

The Hasselblad H Camera System

At Photokina 2002, Hasselblad introduced the H1 camera, a modern medium-format camera with a versatile built-in metering system, motor drive, incredibly fast and accurate automatic

focusing, and lens shutters synchronized up to $\frac{1}{800}$ second for flash. To produce a compact, medium-format camera for handheld photography with the speed and convenience of smaller DSLR models, Hasselblad created a completely new compact camera design and made it for the 6×4.5 cm rectangular film format and for electronic imaging with the largest sensor available at this time.

The H1 camera was updated to the H2 and H3 models for more integration with digital backs. The latest H3D and even newer H3D-II models provide the most professional integration between camera and digital sensor unit so that they can be considered digital medium-format cameras, not film cameras with an attached digital back. For the film photographer, Hasselblad produces the H2F, a camera with the quality, the controlled automation, and the most updated operating features that produce great 6×4.5 film images in the simplest way on 120 or 220 roll film. Some digital backs can also be attached to the H2F.

The H cameras are the first Hasselblad cameras since 1957 that do not offer component interchangeability with the existing 500 and 200 series cameras, except for the tripod coupling. An adapter is available for using CF, CFi, CFE, and CB lenses on the H camera models. The aperture, shutter speed, and focus settings must then be made manually; exposure readings must be made with the aperture manually closed down. This operation somewhat reduces the benefits of the H operating features, but allows you to use the complete assortment of Carl Zeiss lenses that you may have from your film photography.

Since the H cameras are made in cooperation with the Fuji Photo Film Co., the H lenses are made by Fuji. The lenses are made to the same standards and precision as those produced by Carl Zeiss, and their quality is constantly controlled and verified by the optical experts at Hasselblad. The lenses of the H system therefore provide the photographer with the ultimate image quality in the 6×4.5 cm image format as well as in digital recording.

The Hasselblad V Camera System

The V system line of cameras includes all the 500 models, including the current 503CW model, all the motor-driven EL models, the Superwide cameras, the FlexBody and ArcBody, all the 200 models with focal plane shutter, and the cameras from the 2000 series. The V system cameras let you record film images in the 6×6 cm square or in the 6×4.5 cm rectangular format by simply changing the film magazine. You can attach Hasselblad digital backs with sensor sizes 36.7×49.0 , 36.7×36.7 , or 33.1×44.2 to V system cameras for electronic imaging.

The V system cameras are completely mechanical and battery independent. Batteries are used in the 200 series for the metering system and in the EL models for the film transport. The V system cameras are still superb cameras for controlled photography in the studio and for handheld photography on location.

The Hasselblad X Camera System

The Hasselblad X system includes the XPan cameras, lenses, and accessories that were developed in cooperation with Fuji Photo Film Co. and involve a camera concept completely different from that of any other Hasselblad camera. There is no component or lens interchangeability between the XPan and any of the other Hasselblad camera systems.

The XPan is shaped like a 35 mm camera, and the pictures are made on 35 mm film in standard cassettes with 36, 24, or 12 exposures. The images on the 35 mm film can be made in the standard 24×36 mm size or in a 24×65 mm panoramic format. You change the format with a simple turn of a knob, which automatically adjusts the viewfinder image and the frame counter in the camera. You can produce images of both formats on the same roll of film.

SELECTING THE SHUTTER TYPE AND CAMERA OPERATION

During the Hasselblad history, cameras have been produced where the film needs to be advanced manually and models with a motorized film transport. There also have been camera models with focal plane shutters in the camera and others with shutters in the lenses.

Focal Plane Shutters

All Hasselblad cameras in the 200, 2000, and 2003 series, and XPan models have focal plane shutters that provide short shutter speeds up to $\frac{1}{1000}$ second on the XPan and up to $\frac{1}{2000}$ second on the medium-format models.

A focal plane shutter scans the image area from side to side or top to bottom. As a result, different image areas are exposed to light at different times. The flash must fire when the shutter is open over the entire image area; otherwise, only part of the area is exposed. Flash pictures must be made at slower speeds. The top shutter speed for flash is $\frac{1}{125}$ second on the XPan and $\frac{1}{90}$ second on the other V system Hasselblad focal plane shutter models (see Figures 1-1 and 1-2).

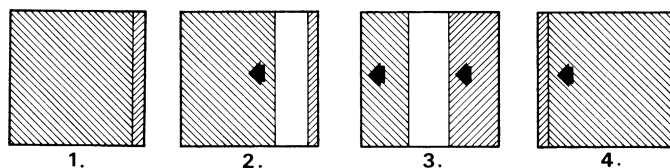


Figure 1-1 With a focal plane shutter, the image is exposed progressively by a slit that moves across the image area. (1) The shutter curtain is closed. (2) The first shutter curtain moves, creating a slit that begins the exposure. (3) The second shutter curtain follows the first. (4) The shutter is closed.

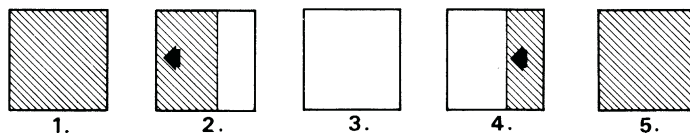


Figure 1-2 At longer shutter speeds, the second shutter curtain begins to move only after the first has reached the other side. Flash synchronization is possible at the moment when the entire image area is uncovered (3).

Lens Shutters

The other type of shutter is in the lens, sometimes called a central shutter, giving the C designation to such lenses in the Hasselblad V system (HC for H lenses). Shutter blades open and close at the set speed, exposing the entire film area at the same time (Figure 1-3). Flash pictures can be made at all shutter speeds.

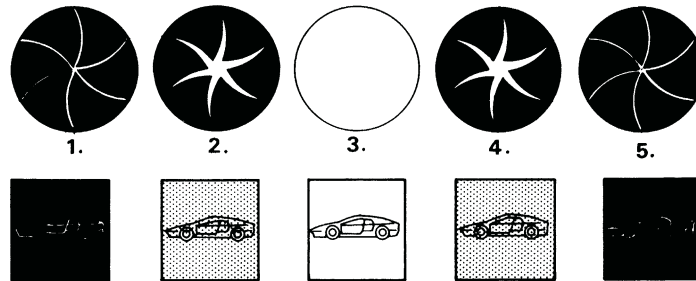


Figure 1-3 With a lens shutter, the entire image area is exposed from the moment the shutter opens until it closes.

Since the shutter blades open from the center and close again toward the center, exposures can vary slightly depending on the lens aperture but the variations are within acceptable limits even for critical photography. The H cameras can be programmed for “true exposures,” which takes into account the set aperture.

Lens shutters, with the shutter blades moving around the optical center, provide the smoothest and quietest shutter operation with the minimum of camera motion or vibrations. The maximum shutter speed, however, is limited to $\frac{1}{800}$ second on the H camera lenses and $\frac{1}{500}$ second on the other shutter lenses. It is recommended to have shutter lenses cleaned and lubricated at regular intervals depending on frequency of use.

Manual or Motor-Driven Camera Operation

On the Hasselblad H and XPan camera, and all EL models, the film is advanced automatically via a built-in battery-operated electric motor. On all the other models in the Hasselblad V line, the film is advanced, and the shutter is cocked manually by a single turn of a knob or crank. On the 503CW, the 503CXi, the 200 models, and on some of the 2000 cameras, a motor winder can be attached, thus giving you the option of advancing the film manually or automatically.

The Advantages of a Motor-Driven Camera

Motor drives were originally built into film cameras mainly for advancing the film automatically to the next frame. The motor drives, however, also make the camera, lenses, and shutters ready for the next image and therefore offer benefits and operating convenience in digital

imaging also. Motor drives eliminate the danger of moving a tripod-mounted camera, helpful in all controlled photography outdoors or in the studio where most photographers shoot more than one picture of the same subject. This is essential in digital imaging when you work in the multishot mode, when you need two images to reduce excessive contrast, increase the sharpness range, or combine images in other ways in computer manipulations.

Sequence operation (shooting pictures continuously during a single press of the shutter release) is another advantage, especially in sport and action photography. The fastest speed is 2 pictures per second on the H models and about 12 pictures in 9 seconds on other motor-driven models.

For most digital and film photographers a motor-driven camera is beneficial for making a second and subsequent pictures without ever removing your eye from the viewfinder whether you work from a tripod or handheld. With a tripod-mounted camera you need not even look into the viewfinder but instead look directly at the subject. This is especially helpful in fashion and child photography where you must maintain complete visual contact with your subject.

Motor-driven cameras also present the possibility of remote releasing. You no longer need to stand behind the tripod-mounted camera. You can be close to the subject, watch expressions closely, play with a child, and snap the shutter whenever the situation is right. Wireless remote releasing is possible on the H models — the 555ELD and the 503 cameras equipped with motor winder.

HOLDING AND SUPPORTING THE CAMERA

All Hasselblad models are ideally suited for handheld work and for working from a tripod. The H models, operated like a 35 mm film or a digital SLR camera, are an exceptionally beautiful tool for handheld photography.

Handheld Photography

For optimum steadiness, hold the camera with both hands and press the viewfinder eyepiece toward your eye and forehead. This creates two forces that oppose each other — the hands pressing the camera toward the eye, and the eye and forehead pressing in the opposite direction (Figure 1-4). This is also the best handheld approach in digital work and is the main



Figure 1-4 Handheld photography. The best camera steadiness is obtained when two forces work against each other. With a waist-level finder, the hands press the camera upward and the eye pushes it downward. With a 90-degree eye-level finder, as on the H cameras, the hands press the camera horizontally toward the eye and with the 45-degree prism finder, the two forces work diagonally.

reason why I like to suggest to all digital photographers to use the viewfinder of the camera to view the image rather than the Preview screen where you must hold the camera a foot away from your eyes so you can see the image on the preview screen. This approach cannot possibly provide a steady support for any camera and is a main reason for blurred pictures.

Consider handheld camera use also for selecting the best camera angle, even if you plan to use a tripod for the final picture. Move around the subject with the handheld camera: view the scene or subject from every angle, from different distances, through different lenses; go down on the ground and view it from below; and go as high as possible and look down. In digital photography, evaluate the different composition on the Preview screen. Set up the tripod, and place the camera on it only after you have exhausted all possibilities and have found the most effective camera position.

Shutter Speeds and Apertures

To reduce the danger of camera motion blurring the picture, shutter speeds must be relatively short. How short depends on many factors, including your own steadiness, your method of holding the camera, the focal length of the lens on the camera, and whether it is windy or calm. The longer the focal length, the shorter the recommended speed.

Based on an often seen suggestion, the shutter speed should not be longer than the inverse of the focal length: $\frac{1}{60}$ second for a 60 mm lens and $\frac{1}{250}$ second for a 250 mm lens. It is a good rule to follow in most situations. I have found, however, that I can use somewhat longer speeds in many situations especially with the H cameras, and I have photographed at $\frac{1}{30}$ and even $\frac{1}{20}$ second with the 80 mm lens and have found the image sharpness completely up to my expectations.

Handheld photography limits the choice of aperture, a drawback in many situations indoors and outdoors. As shutter speeds must be short, the existing light may not be sufficient to photograph at small apertures that provide the desired depth of field. This is the main reason I always carry a small tripod, even for outdoor photography, and use it often even in bright sunlight. It allows me to use any desired aperture and shutter speed combination with any lens and in practically any lighting situation.

Camera Grips and Handles

The H camera has a beautifully designed battery holder and motor drive that also serves as an excellent grip for handheld photography in the horizontal or vertical format. Brackets or grips can be attached to some V system camera models, but be aware that these accessories do not ensure a steadier camera in handheld work. They make carrying the camera more convenient. Detachable motor winders can make a good support for handheld work but they are not designed for carrying the camera between shots.

Reasons for Using a Tripod

Camera steadiness is only one reason for using a tripod. With a mounted camera, you probably spend more time in evaluating the image and are more critical in composing the scene

or subject effectively in the camera. Furthermore, after the composition is made and the lens is focused, you no longer need to look into the viewfinder or on the viewing screen. You can look directly at the subject, which is extremely valuable when you are photographing people. It allows you to communicate more directly with your subjects and direct the people as well as allowing you to take several identical images.

While the mirror and shutter operation in Hasselblad cameras, especially the H models, is beautifully dampened to reduce motion within the camera, you may still want to pre-release a tripod-mounted camera. It is my standard approach with any lens as it is a simple and fast procedure with any Hasselblad camera.

Selecting a Tripod

For studio work you naturally want to use a sturdy studio type. If tripods are taken in the field there must be a compromise between steadiness and portability. The new carbon fiber types seem to offer a good compromise.

A few other points to look for in the tripod design:

- A convenient and fast leg-locking arrangement.
- Convenient camera operation, which is mainly determined by the choice of tripod head. I prefer ballheads. To turn the camera, tilt it sideways or up and down, you need to tighten or loosen only one knob.
- The tripod should bring the camera up to eye level by simply extending the legs, without using the elevating extension. Elevating extensions are for making minor adjustments in the camera height.

Operating the Tripod-Mounted Camera

Most photographers work with a tripod-mounted camera by attaching a release cord and then staying far enough away to avoid any body contact with the tripod or camera. This is a good approach with heavy studio tripods and a necessary approach when working at very long focal lengths or at shutter speeds of about $\frac{1}{2}$ second or longer.

In other situations, especially when working with a lightweight portable tripod, you can also operate a tripod-mounted camera by keeping both hands on the camera or one hand on the camera and the other on top of the tripod with both pressing the tripod and camera toward the ground and perhaps keeping the eye at the viewfinder eyepiece (Figure 1-5C). It is almost like holding the camera as in handheld photography but with the tripod serving as an additional support. You can release the shutter with or without a release cord. If carefully done, pressing the camera release is just as good. You do not have to use the pre-release, but I usually do whenever practical. I use this approach for practically all outdoor photography at shorter shutter speeds up to about $\frac{1}{8}$ second and with lenses up to 250 mm. This approach gives me sharp images from a lightweight tripod.

Monopods can be used instead of tripods for location work when exposure times do not exceed $\frac{1}{4}$ second (see Figure 1-5).

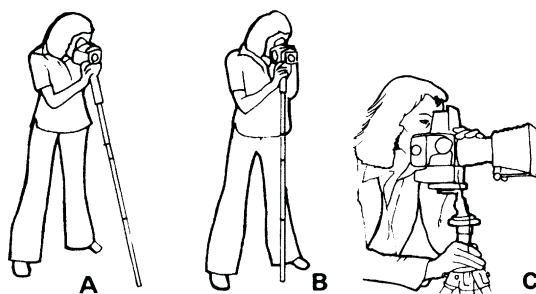


Figure 1-5 Using monopods and tripods. (A) The steadiest position for a monopod is when it forms the third leg of a tripod, with the photographer's spread legs as the other two. The face is firmly pushed against the camera. (B) The camera is not as steady when the monopod is vertical. (C) At shorter shutter speeds, you can prevent camera motion by pressing the camera and tripod firmly toward the ground with the hands and face, an excellent approach with lightweight tripods.

Tripod Coupling

I highly recommend using a tripod coupling on a tripod, monopod, or any other camera stand (see Figure 1-6), as it allows fast and convenient attaching and removing of the camera. Newer Hasselblad tripod couplings have built-in spirit levels for accurate leveling of a camera.

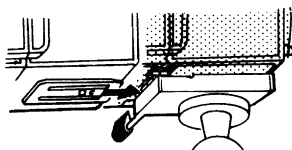


Figure 1-6 Tripod coupling. With a Hasselblad tripod quick coupling permanently attached to the tripod head, you can slide the camera onto the accessory and lock it into place by turning the lever. The latest tripod couplings also have built-in spirit levels.

Image Size and Format in Digital Imaging and Film Photography



The image size recorded in a digital sensor unit (digital back) or digital camera is determined by the size of the sensor in the camera or digital back. Sensors in Hasselblad digital cameras or digital backs can be 36.7×36.7 mm, 33.1×44.2 mm, or 36.7×49 mm, the largest presently available for any camera, including view cameras.

All of these Hasselblad sensors are much larger than the 23×15 mm APS-C sensor used in most professional digital SLR cameras. The Hasselblad sensors are also considerably larger than the 24×36 mm full frame sensor found in a few digital SLR cameras. To be more specific, the area of the 36.7×49 mm sensor is more than $5\times$ larger than the APS-C sensor area and more than double that of the full frame type. The sides of the 36.7×49 mm sensor are more than twice as long as the sides of an APS-C sensor recording a subject more than twice as large, and about $1.5\times$ larger than in a full frame digital camera (Figure 2-1).

Therefore, digital Hasselblad cameras offer the same advantage of recording a much larger and sharper image in the camera as they do in film photography compared to 35 mm or APS cameras. These larger images also offer the photographer much greater possibilities for cropping and changing the image shape. For digital photography Hasselblad offers the same compromise between quality and camera portability that made Hasselblad medium-format cameras popular for critical and serious black and white and color film photography for so many years.

DIGITAL IMAGE QUALITY

The digital image is formed on the sensor in the camera or digital back by pixels that are light sensitive to either green, blue, or red. The resolution is indicated by the total number of pixels, which is obtained by multiplying the number of pixels along either side of the sensor. For example, a 39 megapixel specification is obtained by multiplying the 5412 and 7212 pixels along the image sides. Most professional digital SLR cameras have resolutions from 6 to 12 megapixels, some newer ones going as high as about 20 megapixels. Hasselblad digital backs or cameras offer resolutions from 22 to 39 megapixels.

The number of pixels is directly related to the image quality produced in the camera. The higher the number of pixels, the better the image quality but only if everything else is equal,

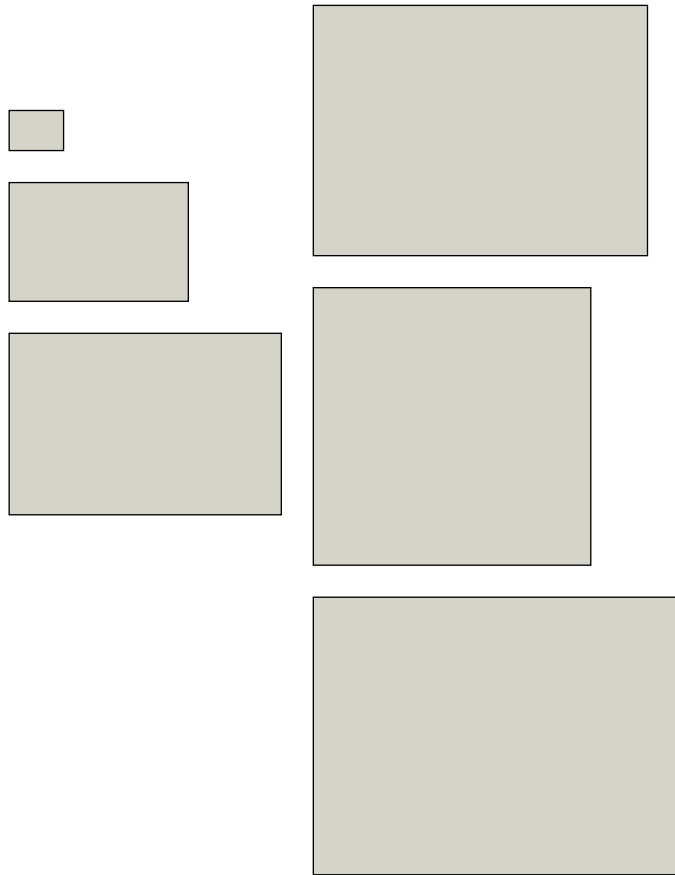


Figure 2-1 Digital Sensor size comparison. The Hasselblad sensor sizes, with the 36.7×49.0 sensor on bottom right, the 36.7×36.7 sensor in the middle right, and the 33.1×44.2 sensor at the top right are shown in comparison to the sensor sizes in other digital cameras. All three Hasselblad sensors are considerably larger than the full frame sensor of 24×36 mm (bottom left) found in a few digital SLR cameras, and much larger than the more common sensors, the APS type with a size about 15×23 mm (middle left) found in most professional SLR cameras and the even smaller Compact type (top left).

especially the size of the sensor, the size of the pixels, and the performance of the lenses. Lenses of questionable quality limit the image sharpness in digital recording as they do in film photography but to an even higher degree. In digital cameras, the performance of the lenses, especially in regards to the chromatic aberration, distortion, and image brightness in the corners of the images, can be improved somewhat by what is known as DAC (digital auto correction). This correction, however, shows benefits only in an image that is recorded with a high quality lens. Some camera manufacturer's claim may give the impression that a specific camera produces higher quality images because of DAC. Such a statement is not based on any true facts. DAC does not produce high quality in an image taken with a lens of questionable

or poor quality. The topic of DAC is discussed more in the chapter on lenses where you can also find an MTF diagram that shows how much DAC improves the quality in an image created by a 35 mm HC lens on H cameras.

Pixel Size

Digital cameras are promoted, separated, and distinguished mainly by the pixel number with the conveying message that a camera with a higher pixel number produces a sharper image. While the pixel number increases resolution, the number of pixels is only part of the quality story. The pixel number can be increased in two ways, either by placing more pixels on the same size sensor in which case the pixels need to be smaller, or by increasing the size of the sensor in which case the pixel size may not have to be reduced or can even be increased. It is no problem for a manufacturer to increase the number of pixels and produce a digital camera with a fabulous megapixel number but the more pixels the manufacturer puts on the same size sensor the smaller the pixels need to be. The benefits in image quality from such a sensor where tiny pixels are cramped onto a small sensor then become questionable because larger pixels do perform better photographically with increased information gathering power. A larger pixel collects more light and its signal needs to be less magnified thus creating less “noise,” as it is called in digital imaging. Small sensors are more susceptible to noise especially when used at higher ISO values. The increase in the sensor's dynamic range produces images with a better tonal range from the deepest shadows to the brightest highlights, better colors, finer tonal gradation, and more attractive shadow details allowing for the production of gigantic prints. The improvements are usually especially noticeable in the highlights. The larger Hasselblad sensors offer these improvements because they not only allow a larger pixel number but also pixels of a much larger size. Hasselblads provide $16\times$ more information with a 16-bit depth providing 65,536 shades of gray compared to a 12-bit depth with 4096 shades of gray on a typical DSLR camera.

Because of the danger of creating noise, digital photographers are advised to photograph at the lowest possible ISO setting. This is certainly good advice, but it also means that in low light situations you may have to choose between using a higher ISO which allows shorter shutter speeds or a lower ISO which may require longer shutter speeds that may create unsharpness due to camera motion. In such a case a higher ISO is definitely recommended especially with Hasselblad. The larger sensor with larger pixels can produce better image quality at ISO 400 than a smaller sensor with smaller pixels at ISO 100 just as the newer 400 ISO negative or transparency films produce considerably sharper images with finer grain than the older films at ISO 100. A file with all the information from the larger sensor with larger pixels will also survive post manipulations much better.

Sensor Size

The size of the pixel needs to be considered seriously and is determined by the size of the sensor. A typical DSLR camera may have an APS-C sensor with 8 megabytes on the image area of about 340 square mm. The Hasselblad 36.7×49 mm sensor of 39 megabytes has more than $4\times$ as many pixels on an image area that is also $5\times$ larger. There are not only more pixels but all the pixels are larger. The greater number of larger pixels is what sets medium-format digital imaging apart just as the medium format did in comparison to 35 mm in film photography.

With the constant and rapid changes in digital cameras, selecting the larger Hasselblad digital format will likely keep the equipment updated for a longer time period reducing or eliminating the danger that the equipment will become outdated within a short time, a common fear with the rapid and constant new developments in digital camera equipment. Working with the larger digital Hasselblad format, rather than the digital SLR cameras that other photographers use, may also help professional photographers to attract new clients for high paying quality jobs and keep these clients for future assignments.

Just as in film photography exposure is another determining factor for image quality but in digital work, perfect exposure is even more critical, something to remember especially by photographers used to the great exposure latitude of color negative films. Digital exposures are even more critical than they are with transparency films.

SENSOR SIZE AND FOCAL LENGTH OF LENS

The 36.7×49 mm Hasselblad sensor is the largest sensor that can be fit into a camera designed for the 6×4.5 film format, and is very close to the 42×54 image size of a 6×4.5 negative or transparency. This close size relationship between digital and film images is advantageous because the camera lenses cover practically the same area on this large sensor as they do on a film magazine 16. You do not have to re-think what focal length lens to use. The conversion factor is only 1.1. The standard 80 mm becomes equivalent to one just slightly longer with an 88 mm focal length. The 35 mm wide angle is still a superb wide angle lens that performs like one of 38 mm. For all practical purposes you can use all the lenses as you would, or have done, or still do when working with film.

As discussed in more detail in the chapter on lenses, area coverage is determined by the focal length of the lens in relation to the film format or the sensor size. An 80 mm lens covers a larger area on the 6×4.5 film format than it does on 35 mm. On most digital SLR cameras (except the full frame type) the sensor is much smaller than the 35 mm film format, so you need to work with a conversion factor of $1.5\times$ or larger. Digital recording requires a wide angle lens to cover the same area as the standard lens does in film photography. Extreme wide angle lenses are practically nonexistent for digital recording. The specification sheets for such digital cameras usually do not mention the actual focal length of the lens on the camera but give you a focal length that is equivalent for the 35 mm film format.

With a Hasselblad 36.7×36.7 sensor the focal length factor is 1.5 compared to the $2\frac{1}{4}$ square format so the 80 mm lens performs like one of 120 mm focal length. The 50 mm wide angle covers the area of a 75 mm lens in film photography. With a 33.1×44.2 sensor you multiply the focal length of the lens by $1.25\times$ compared to the 6×4.5 film format, so the 80 mm lens covers the area equivalent to a 100 mm type on film and can still be considered a standard focal length.

IMAGE SIZE IN FILM PHOTOGRAPHY

Except for the XPan model, Hasselblad cameras are made for the medium format, which combines many of the advantages of 35 mm and large format photography. By simply switching the magazine on any camera model, you can record images digitally, on black and white or

color film, and on instant recording film. You can also record them on either 120 or 220 roll-film or on 70mm long rolls (Figure 2-2). On all V system cameras, you can also produce the images in the square or rectangular format.

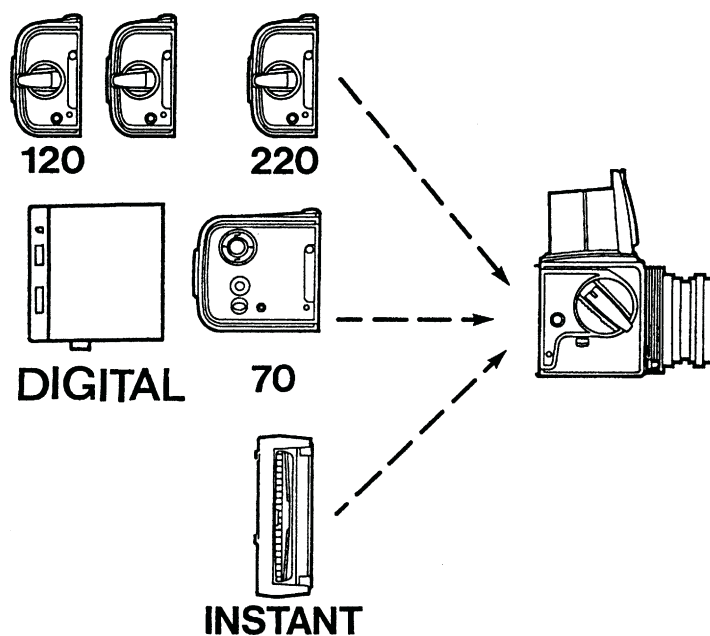


Figure 2-2 Magazines for electronic imaging. A digital imaging back can be attached to most Hasselblad cameras in the V system in place of a film magazine. Some H cameras are, or can be, equipped with various digital backs, an instant film magazine HMi 100, or a film magazine HM 16-32 for 120/220 rollfilm. H3DII cameras are supplied with a digital back and are for digital imaging only.

The $2\frac{1}{4} \times 2\frac{1}{4}$ in. Square Format

Since 1947 many photographers selected Hasselblad V system cameras not only because of the larger image format but because they liked recording images in the square format (Figure 2-3). The $2\frac{1}{4} \times 2\frac{1}{4}$ in. (6×6 cm) square format established the popularity of the medium-format cameras. The exact image size is 54×54 mm, with 12 images on one roll of 120 film and 24 on the 220 type.

Many good points can be made about photographing in the square format. You do not have to decide the final image shape when you take the picture. A square can be changed beautifully into a rectangular image without losing image sharpness if you leave the long image side in its original length of 54 mm. You also do not have to decide which way to turn the camera when you take the picture. The 12 square images from a 120 roll of film make beautiful proof sheets on a sheet of 8×10 in. paper, with all the images right side up, so you never need to turn the proof sheet.



Figure 2-3 Square image format. Most outdoor scenes can be composed effectively in the rectangular or square format. In either format, we must compose to have important image elements going from side to side and from bottom to top. The white waves lead the eye from the bottom left to the Italian village at sunset on the upper right. (Photo by Ernst Wildi.)

The 6×4.5 cm Format

In the V system cameras, you can obtain images in the 6×4.5 format by attaching a film magazine A16, A32, earlier E16, or E32 types. The Hasselblad cameras in the H system are made specifically for the rectangular 6×4.5 format so you need to turn the camera for vertical pictures. The H cameras and viewfinders are beautifully designed for doing this handheld or on a tripod.

The exact image size of the 6×4.5 cm format is 54×42 mm, which corresponds closely to the shape of standard enlarging papers. Because the long side of the image is the same as on the 6×6 square, image quality is identical. The 6×4.5 cm images are not smaller images, only images of a different shape. When you photograph in the 6×4.5 format, you must decide before you photograph whether the picture should be horizontal or vertical. In return, you obtain more images on the film: 16 on 120 type and 32 on 220 rollfilm (Figure 2-4).

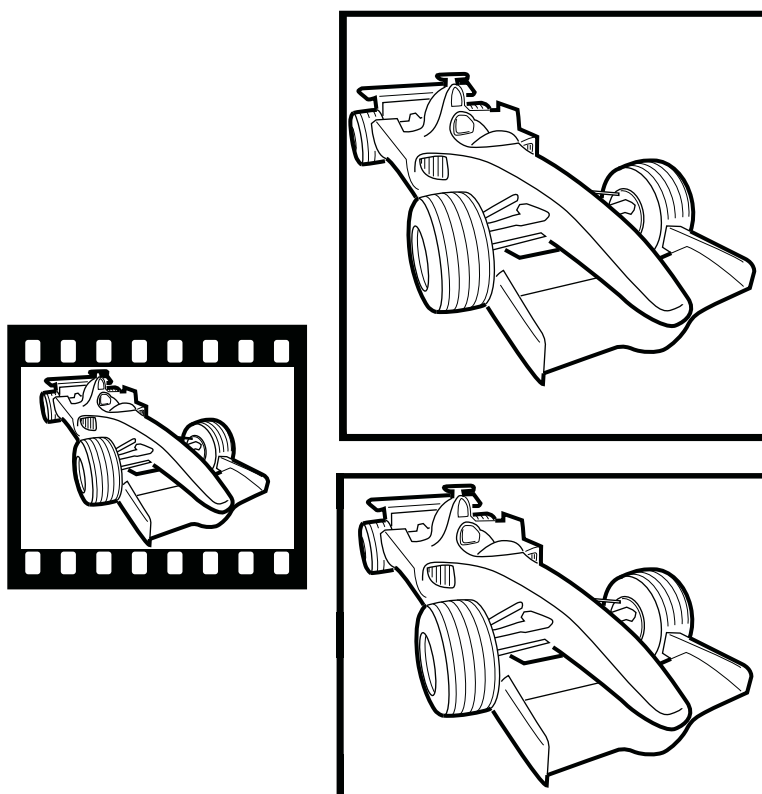


Figure 2-4 Film format size comparison. The Hasselblad 2¼ square (6 × 6) format (top right) and the 6 × 4.5 format (bottom right) are shown in comparison to the 35 mm film format (left).

The Superslide Format

Hasselblad used to offer a special film magazine (A-16S) for the Superslide size of 41 × 41 mm small enough for transparencies to be projected in 35 mm projectors. While projected Superslides are very effective, the format never became very popular partially because some 35 mm projectors could not project Superslides without darkening the corners of the images.

The Panoramic Format

Images are considered panoramic when the long image side is at least twice as long as the other side. With the Hasselblad XPan camera, you can create panoramic pictures 24 × 65 mm right in the camera on standard 35 mm film.

The medium-format film image size, or the image size on the 36.7 × 49 mm sensor, is also large enough so that you can create effective panoramic images of perhaps 18 × 54 mm or 18 × 49 mm by simply printing only a portion of the original image or masking the

transparencies in the panoramic shape (Figure 2-5). Hasselblad produced a panoramic mask that fit into the rear of the newer V series cameras to mask off the unused area of the film.

In digital imaging, panoramic pictures can be created in the computer by stitching together overlapping images taken in the same location with the same camera and lens.

The 6 × 7 cm Medium Format

Hasselblad never produced a camera for the 6 × 7 cm medium format because the 20% difference in the longer image dimension did not produce sharper images, reduced the number of images on a roll of 120 film from 12 to 10, and would have required a larger camera that no longer provided the mobility and convenience that made Hasselblads such great tools not only for critical studio work but candid, handheld location and wedding photography as well.



Figure 2-5 Creating panoramic images. The images created on the large Hasselblad digital sensors or the Hasselblad medium film format are large enough so they can be changed into panoramic shapes while maintaining image quality. (Photo by Ernst Wildi.)

DECIDING ON THE IMAGE SHAPE IN DIGITAL AND FILM PHOTOGRAPHY

When photographic images are used in advertising, on magazine covers, in brochures and catalogs, or for many editorial purposes, the final image shape is determined by the use of the image. In most other cases, the photographers determine whether the image should be square, rectangular, or panoramic and make their decision based on personal preference for a specific shape or based on what format seems to be most effective for the photographed subject or scene. I have seldom found a problem composing subjects or scenes in the square or the rectangular format, even though I originally worked with motion picture cameras where you had no format choice and every scene had to be composed in the horizontal format.

While I personally like the equal dimensions in width and height that give the square a pleasing and harmonious quality and also allow me to change the square into a rectangle



Figure 2-6 Composition in different formats. Scene in a Western ghost town composed in the square format with the brightly colored gas pump to the right and the old car filling the area all the way to the left border. This same composition could have been created in the horizontal format from a camera position somewhat more toward the left. (Photo by Ernst Wildi.)

without losing image quality, I feel that almost any subject, at least outdoors, can be effectively composed as a square, a horizontal, or a vertical. Doing so naturally requires photographing the subject or scene from a somewhat different camera position, perhaps even at a different focal length (Figures 2-6 and 2-7).



Figure 2-7 Composing in different formats. While this scene in the Dakotas seems to fit perfectly into the horizontal rectangle of the H camera, it could have been effectively composed as a vertical rectangle or a square by concentrating on the two pumps and silo on the left side. (Photo by Ernst Wildi.)

Digital Imaging with Hasselblad



DIGITAL OR FILM

Some photographers, especially professionals, still need to decide whether to work digitally or with film at least for certain jobs. The decision may be based on personal preference perhaps the way colors and contrast are recorded in either media, on a clients preference, the use of the image, the size of the enlargements, or other reasons. If a digital image is desired or necessary just for the purpose of having the final image in digital form for storage or for image manipulations, you want to keep in mind that such an image does not necessarily have to be recorded in the camera in digital form. Any image, black and white or color, on negative or transparency film, can be scanned and changed into a digital image. Hasselblad produces a line of professional Flextight scanners for this purpose. A scanned image can be retouched or manipulated in the computer just like a digital original.

DIGITAL IMAGING IN THE MEDIUM FORMAT

When digital imaging became a new photographic media, medium-format film cameras became digital imaging tools by attaching a digital back to existing camera bodies rather than completely new cameras designed specifically for digital imaging. Since most medium-format cameras were designed with interchangeable camera backs, this was a logical and simple solution and was also used by Hasselblad in combination with digital backs made by various manufacturers. This approach worked well since Hasselblad cameras were recognized as good tools for any type of studio or location film photography and produced superb image quality in combination with the Carl Zeiss lenses. It was also an economical solution as Hasselblad photographers did not need to invest in a completely new camera and lens system, and because one and the same digital back could be attached to different Hasselblad camera models including cameras with shift and tilt control.

Digital technology, however, has also changed drastically over the last 15 years, and Hasselblad realized the importance of keeping up with the trend toward digital photography. The company sped up the development of new digital recording devices and digital cameras through the merger with Imacon, a recognized manufacturer of high quality digital backs and scanners. The work within this new Hasselblad company resulted in a rapid development of completely updated and integrated packages of lenses, cameras, viewfinders, digital capture units, and software. The first product from this new design approach is the H3D camera,

which can be called a true digital medium-format DSLR camera. Combined with a sensor that is almost as large as the 6×4.5 film format, this camera is now recognized as a full frame DSLR medium-format camera.

HASSELBLAD'S ADVANTAGES IN DIGITAL IMAGING

In addition to the superb image and tonal quality created by the large Hasselblad sensor units with larger pixels, digital imaging with Hasselblad can help a professional or amateur photographer in other ways. If you presently do your film photography with Hasselblad, you do not need to invest in a completely new digital camera and lens system. Just invest in (or rent) a digital back and switch from the film magazine to the digital back. For most Hasselblad camera models, you have a choice of different digital backs with different specifications so you can select one (or rent one) that you feel is best for your particular type of photography.

The interchangeable component design allows you to use the same camera, lenses, and accessories for film photography as for electronic imaging. In addition to the financial advantage, this is helpful when you may still use film for some applications or clients and digital imaging for others.

Working with the same camera in both media gives you more time to think about image quality, composition, and photographing the subject in an effective fashion rather than constantly switching cameras and worrying about operating each camera in the proper fashion. Working with the same camera and lenses for film and digital photography makes sense because recording either type of image is based on the same principles and requires the same camera and lens operation. The image is simply recorded on a different medium. The real differences between film and digital photography come after the image is recorded in the camera, when you have to decide whether to leave the image as it is or change or improve it and how to store it for possible future use.

Most Hasselblad digital backs can also be used on various Hasselblad cameras, so you can select the camera model that is best for a specific job; use a 200 model camera because of its excellent built-in metering system, or take advantage of the shift and tilt controls in the ArcBody or FlexBody for an architectural job. By investing in one back, you can convert two or three different film cameras into cameras for digital imaging. If you do not own some of these special Hasselblad camera models, look into rental possibilities.

Furthermore, the Hasselblad CF digital backs are designed with an adapter system so they can also be used on other makes of medium-format and view cameras. You do not need to buy another digital back for other cameras that you might be using.

The Question of Obsolescence

With new digital equipment introduced constantly and the new features of these cameras promoted to the point of giving the photographer the impression that their present equipment is completely outdated, photographers, especially professionals, are naturally concerned about obsolescence of their equipment. Many photographers feel, or are told, that upgraded equipment produces better image quality and therefore might improve profitability.

There are certainly good reasons to be concerned about obsolescence, but consider carefully whether new equipment makes your photography or digital process more precise or more convenient, improves your productivity or profitability, or allows faster shooting if this is important in your field of photography. While this concern for obsolescence also applies to Hasselblad, I feel it is greatly reduced for various reasons but especially regarding image quality. The sensors in the present Hasselblad cameras and digital backs are much larger than those in typical professional digital cameras, even larger than a sensor that could physically fit inside digital cameras, even the full frame types. With the Hasselblad sensors having a much higher pixel number as well as considerably larger pixels, Hasselblad's present image quality is far beyond what can be accomplished even in the most updated digital cameras and is likely to remain that way for some time in the future. Hasselblad digital cameras and digital backs are also constantly updated to produce high quality results for a longer period of time (Figure 3-1 and 3-2).

As a result, the Hasselblad cameras or digital backs are more likely producing updated high quality digital results for a longer time period and do not have to be replaced as often, if



Figure 3-1 H System digital image. A beautifully composed image in Las Vegas recorded digitally in the H3D-31 Hasselblad camera with HC 2.2/100mm lens at ISO 800 setting. (Photo by Paul Claesson.)

at all, as other digital cameras. Your computer is more likely outdated before your Hasselblad camera. And when the time for a change or update eventually arrives, you may only need to replace the back and not the entire camera and lens system or Hasselblad may be able to upgrade your camera or sensor unit.



Figure 3-2 V system digital image. A beautiful digital creation made visually effective by the two completely different patterns — the sharp outlines in the electrical component box and the free flowing bright red graffiti. Photographed with Hasselblad CFV 16Mp digital back with 36.7×36.7 sensor at ISO 50 on a V system camera with Sonnar 250 mm lens. (Photo by Bob Gallagher.)

PHOTOGRAPHY'S TWO-STAGE PROCESS

Film photography has always been considered a two-stage process with stage one recording the image in the camera and stage two involving the development of the black and white or color film and printing the image from the negative, if such film was used in the camera. Most Fine Art black and white photographers still work like this, developing the film themselves and making their own prints. Most other film photographers, even professionals in fields like portrait and wedding photography limit their own involvement to taking the picture and then

let outside sources do the rest. While Fine Art film photographers often spend much more time working on an image in the darkroom than they did or do when creating the image in the camera, most other film photographers spend most or all the creative time behind the camera.

Digital imaging in color or black and white is also a two-stage process with stage one taking the picture and stage two working on the image in the computer. As in film photography, most digital casual photographers however limit their own work to stage one, taking the picture in the digital camera and then letting an outside source do stage two. For serious digital photographers and professionals on the other hand stage two has become the more important step in creating the image and many serious digital photographers, probably most of them, spend hours, perhaps days working on an image in the computer while they spend just a few minutes recording the image in the camera. The entire photographic process in regards to the time spent in stages one and two is completely reversed from what it used to be in film photography. Nothing wrong especially since the main enjoyment for many digital photographers comes not from creating the image in the camera but from working with the image in the computer, retouching it, improving the quality by making it brighter, darker, or sharper or by adding a soft touch or changing colors in the entire image or part of it. A new image with little resemblance to the original photograph can also be created by making the images more effective by changing the composition or the background, or producing double exposures by combining different images.

The main interest for these enthusiasts or professionals is creating images in the computer not in the camera. This is understandable not only because sitting in front of a computer may be more pleasurable than working with cameras, lenses, and accessories out in the cold, heat, fog or rain but also because these computer manipulations have created completely new possibilities for creating photographic images, new enthusiasm for photography, and have attracted newcomers to photography who never before had a serious interest in cameras. These new developments can only benefit photography as the work on the computer may develop the photographer's artistic capabilities. Before working on the computer, you naturally want to evaluate the image to determine what changes should be made and to what extent, if any, the image should be manipulated. I also like to remind news photographers that you need to be aware that any image manipulations, even minor ones, are frowned upon. News pictures are supposed to show things as they were when recorded in the camera. If you feel that the image must be changed even in a minor fashion, you must inform the picture editor.

Since creating the original image still involves a camera, I also hope that digital photographers will continue to consider the camera and lens, not the computer, the main component for creating the digital image, unless you like to become recognized as a "computer photographer" and your images as computer produced works of art rather than camera or photographic art. Some years from now this separation between camera and computer produced images may be reduced or may completely disappear and all images may become recognized as computer photography.

RECORDING A PERFECT IMAGE IN THE CAMERA

This trend toward computer produced images made some photographers concentrate all their artistic efforts to the work on the computer screen. Retouching and changing the image

has become their main photographic activity, perhaps, influenced by the often heard comment that one no longer needs to be concerned about creating an image of the highest quality in the camera since all the faults, including unsharpness, can be corrected afterwards. As a result, some digital photographers consider the effective use of camera and lenses in a secondary fashion. They no longer realize the importance of planning a shot and no longer operate the camera with the same feeling that previous film photographers had. The extensive automation in modern digital cameras has also encouraged photographers toward the snapshot approach of letting the built-in automation decide the camera operation and the lens settings. This trend toward uncontrolled shooting and pushing the camera release without carefully analyzing the situation and the camera and lens settings seems also to have taken place among professional photographers, especially in wedding photography. Many wedding photographers who changed from film to digital will tell you that they shoot twice as many pictures with a digital camera than they ever did on film. Since wedding photography means mainly photographing whatever happens in front of the camera, there may very well be financial advantages in this new approach, but one must also question whether this approach leads to better photography and produces better photographers.

While many faults can be corrected and images can be improved in the computer, you must realize that most image manipulations are not done easily, need special software, require much computer knowledge if they are to look professional, and are also very time-consuming if you want to do them yourself and costly when done on the outside. Unless your main interest is in creating completely new images in the computer, I feel that you will be most successful in your digital photography, will get you away from snap shooting, and will make you a better photographer if you try to record an image in the camera that is as perfect as possible and needs little or no after work on the computer. Work with your digital camera or digital back as you might have worked with film assuming that nothing can be changed afterwards and that the image recorded in the camera is the image that you and your client will see. Some of the new computer-educated photographers may consider it old-fashioned and out-of-date if you fiddle around with your camera and lenses trying to determine the best camera and lens settings and trying different lenses and experiment with filters, or when you evaluate the subject carefully to find a camera position that produces the visually most effective image. Do not let that bother you. Trying to produce a perfect and visually stimulating image on the digital sensor or on film is still the sign of a good and creative photographer. Working in this fashion is an especially recommended approach with Hasselblad cameras and lenses, which offer a wealth of wonderful possibilities for creating fascinating images in the camera in the simplest and most enjoyable fashion (Figure 3-3).

Naturally you always want to investigate what corrections or retouching can be made to improve the image and, if you do such work, make certain that the retouched areas have the same qualities as the unmanipulated areas so the corrections are not obvious and are not distracting.

Since I still consider the use of the camera and lenses most important for creating effective digital images, and since I consider *The Hasselblad Manual* a book that should help create good images in the camera, the information and instructions regarding the after manipulations of the image, which usually involves Photoshop and other image manipulating hardware, is limited just as information about film processing and darkroom techniques was



Figure 3-3 Film image. Picture taken with 250 mm telephoto lens on ISO 400 transparency film in a 205 camera using the built-in metering system to determine exposure. The bright reflection on the water was accurately composed to lead directly to the end of the broken-down pier and the lamp post in the foreground. (Photo by Ernst Wildi.)

never a part of the *Manual* in the years of film photography. All the photographs published in the *Manual* are also images as they were recorded in the camera without any, or very minor computer manipulations. That means that all the images could have been created on film or digitally using the same camera techniques and for this reason I do not mention the media used in most illustrations. By doing this, I hope that the photographs inspire you to use the cameras to produce more effective visuals instead of worrying about which media was used.

To learn the possibilities of image manipulation, all photographic magazines today have helpful and interesting articles on these topics, numerous books are available that discuss any and all aspects of image retouching and manipulations and workshops on these topics are constantly held at least in the United States. Study as much as you can, I highly recommend attending workshops conducted by recognized digital photographers.

The Hasselblad Manual goes into great detail about all the camera operations, the options you have in the camera, and lens controls to produce images in the camera with the

qualities and characteristics that you or your client expects. Follow these suggestions whether you work digitally or with film. To me this is still the basic and most important part of photography regardless of whether you create the images on film or digitally.

HELPFUL COMPUTER MANIPULATIONS

While it is helpful trying to produce a perfect image in the camera, it must be mentioned that the computer offers many possibilities for improving images in ways that are difficult, impractical, or impossible to do in the camera. This may involve nothing more than eliminating distracting elements within the subject or scene or in background areas (Figure 3-4).

Digital imaging has also opened possibilities for producing images with photographic qualities that are impossible to produce in the camera on film or digitally. The two most valuable ideas involve creating images with a wider range of sharpness and with more details in shadow and/or highlight areas. The contrast range, the amount of details that are recorded in shaded and lighted areas, is limited in film and digital photography. In the computer you can combine two identical images: with one exposed for details in the shaded areas and the other exposed for highlight details. Combining the two can produce an image with details in shaded and lighted areas that is impossible to cover in the original image.

The maximum range of sharpness in a camera-recorded image is determined by the lens and the lens settings with the maximum range obtained with the shortest focal length lens set to the smallest aperture. In the computer you can combine two or three identical images but one focused for the shorter and the other for the longer distances with a third set for the medium range. The final images can have a sharpness range far beyond what is possible in camera-recorded images without tilt control. Double and multiple exposures for the purpose of creating different and perhaps better works of art is another great possibility offered by the computer.

Producing architectural with straight and parallel verticals is difficult or impossible without special camera equipment that allows shifting the lens or image plane but can be done relatively easily in the computer. Other helpful possibilities for improving the technical quality of images in the computer are discussed further in the text.

HASSELBLAD DIGITAL CAMERAS AND CAMERA BACKS

Digital Camera Backs

The Hasselblad H1 and H2 cameras and all the different Hasselblad V system camera models can be changed from film to digital by attaching a digital back in place of a film magazine. This includes the camera models used for special applications like the FlexBody and the ArcBody. You can produce just about any type of digital image in any field of photography right in the camera and eliminate time-consuming image manipulations afterwards.

In addition to the Hasselblad digital backs described in the manual, a number of other companies also manufacture digital backs with different sensor sizes and resolutions that can also be used for digital imaging with the different Hasselblad camera models. This list includes digital backs made by Imacon before and for some time after the merger with Hasselblad. Most are known under the trade name Ixpress.