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Retro Photography Part I: Dedicated Film Scanners

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

Introduction

Scanning film negatives and transparencies is still an ongoing function for printers, publishers and some graphic communication educators. This is because of the millions of existing film images that exist today. Photographers who still shoot film for artistic purposes also frequently scan negatives. New dedicated film scanners, especially for medium and large format film, are not as common. One example is Nikon's complete line of film scanning equipment that was discontinued in 2012.

A film scanner uses a microscope objective and a linear imaging chip to scan a small area of a negative at a time. The linear chip used in scanners is becoming less common because the market for film scanners has become smaller. Film scanners are fragile and break often due to the motors and gears within the scanner. The negative carriers are especially fragile in student's hands because most are plastic and glass. There are very few businesses that repair film scanners. The price of used film dedicated scanning equipment with a current computer interface such as USB or Firewire have been increasing in value due to supply and demand.

This article helps educators on a budget select used film scanning equipment. It does not attempt to teach film scanning techniques. Two recent books on scanning software are located in the reference section of this article (Steinhoff, 2011, 2009). Low cost medium and/or large format film scanners that cost less than $500 will be covered. The $500 price point was set because this is the average repair cost of a dedicated film scanner. Used low cost 35mm scanners will also be considered in the $35–100 price range.

As of 2016, new dedicated medium and large format film scanners were $1,400–20,700. This article does not consider CCD imaging scanners at the low end of the market found at office stores. This article does not consider the highest end of the market either-drum scanners are no longer available new and used Flexlight scanners are beyond the budget of most educators. For medium format such as 6x5-cm, 6×6-cm, and 6×7-cm there were three new choices: The Pacific Image PrimeFilm 120 Pro ($1,400), Plustek OpticFilm 120 Film Scanner ($1,700) and Hasselblad Flextight ($13,400–20,700). The Flexlight scanners were the only 4×5-inch large format dedicated film scanners for sale. The Pacific Image 35mm film scanners were $300–$400 and Plustek 35mm film scanners were $329–$479.

Note: Prices provided are averages from 2015, and are given as a guide to educators on purchasing used equipment in this time period.

Flatbed scanners

Some graphic communication students have experience scanning film negatives with flatbed scanners. The image obtainable from a general-purpose flatbed scanner is of lower quality with respect to sharpness and shadow detail (figure 1). Even the least expensive flatbed scanners do a good job with reflective media such as scanning 8×10-inch or larger prints. The optical path in a general-purpose flat bed scanner is an optical compromise with transparent copy. Flatbed scanners produce lower quality scans than a dedicated film scanner. This is true even with flatbed scanners that have a second lens for film scans. Multi purpose scanners are more complex and often less reliable. Film scans on multi function scanners also have problems such as light leaks with veiled shadows and trapped dust that is hard to clean. **Insert figure 1**

Imaging the negative all-at-once versus scanning

A scanner scans the negative one line at a time and an imager takes a picture of the negative all-at-once. An all-at-once device is an optical compromise. Kodak professional "scanners" used in the photofinishing industry were three-shot imagers through red, green and blue filters. Images were acquired all-at-once with black and white CCD sensors through the color separation filters. The earliest desktop scanners (made by Leaf) made scans through color separation filters and were not imagers. Early graphic arts drum scanners used photomultiplier tubes and color separation filters and were scanners and not imagers.

The concept of an all-at-once film imager is a good classroom project. A digital back on a medium format camera can be used to shoot photos of negatives directly. A Hasselblad 503 CX with a 6MP digital back, a bellows, two extension tubes and a 120mm Zeiss Makro-Planar T* f/4 lens were used to shoot a picture of a medium format

This a scan of an 8×10-inch Iford FP-4 Plus negative on the Epson Perfection 4990 Photo flatbed scanner. This is a previous model to the current V700 flatbed scanner. The scan does have less detail in the shadows when compared with a contact print on photographic paper in a conventional darkroom.

Figure 1

This is a photo taken from a negative on a Hasselblad copy camera. The edges of the photo have a fall-off of sharpness that a scanner produced file would not have.

Figure 2

negative (figure 2). A piece of opalescent glass with a continuous light was used behind the negative. The all-at-once copy technique produced less sharpness when compared with an old dedicated film scanner such as the obsolete Polaroid Sprintscan 120, which will be described later in this paper. The copy camera image was about equal to a flat bed scan of a negative.

Effective and actual resolution for scanning

Resolution requirements are dependent on what type of film is encountered. There are high-resolution black and white document films, which are a high contrast litho type film that can be developed for continuous tone. Kodak Tec Pan or the current Rollei Ortho 35mm have much greater resolution than the average film stock scanned by printers (Figure 3). Kodak Ektar color negative film also has a high resolving power. Perceived sharpness and resolving power are two different characteristics.

A scanned image with high resolving power can appear to be less "sharp" when compared to a scan with lower resolution and more sharpening with the unsharp mask feature in Photoshop. This is an old principle with optics as well. Older Ziess lenses do not necessarily resolve more detail than current lenses but they do appear to produce greater sharpness because they have more optical contrast. For most pictorial applications better optical quality is not necessarily raw resolving power. This is because the visual appeal of the image is more important than how much information was resolved. There are exceptions to this if the images are strictly for information only such as an industrial application. Digital photography would be used for most industrial applications today. One example is aerial map-making photography. Some aircraft may still be using film photography but for the most part digital medium format backs are more common for industrial application.

This is an enlarged section or about ⅛ of a 35mm Kodak Tech Pan negative. This is a high contrast litho type film developed as continuous tone in a special low contrast developer. Rollei makes a current version of this film.

Figure 3

Low resolution lenses are often used with current high-resolution films such as Rollei ATP1.1 Advanced Technical Pan or Kodak Ektar for artistic or amateur applications. In theory medium format Rollei ATP film has a much greater resolving power than an older Minolta Multiscan medium format scanner. There are only a few single focal length lenses (not zooms) that would approach the resolving power of Rollei ATP medium format film. High resolution lenses such as a 80mm Hasselblad H-series lens ($900 used) and Rollei ATP medium format film are expensive.

Low cost films such as ISO 100 Freestyle Arista.edu or Foma 100 and a 100–200mm zoom for a Mamiya RZ-67 6×7-cm camera are well matched to low cost used scanners such as the Minolta Multiscan. The Multiscan is described in a subsequent section of this paper. This later combination of film and equipment has more than enough resolution for portraits for example.

Computer interface selection for low cost scanning equipment

One of the chief criteria when searching for low price scanning equipment is the computer interface. Used Firewire or USB brand name scanners are more expensive than older interface SCSI scanners. USB and Firewire scanners are the most expensive scanners because they work on the newest operating systems and with the most current computer hardware. SCSI is a commonly included interface on older Macintosh computers and it was also quite common on Windows computers with a PCI add-on card.

Up until recently a Firewire to SCSI converter was made by Ratoc. The Ratoc FRSX1 has been discontinued because the chip within it is no longer made. These adaptors were under $200 new in 2016 and typically sold for $350 used. There also were USB to SCSI adaptors available but these are generally not compatible with scanners and are not recommended by the author. The discontinuation of the Ratoc FR1SX is good news for those searching for under $500 SCSI medium and large format scanners. SCSI scanners dropped in price as a result of the FR1SX being discontinued.

VueScan and old scanners

VueScan is the author's software of choice for running many different old scanners of various types including USB, Firewire and SCSI. VueScan is available for $89.95 for one Pro license (hamrick.com, 2016). Each install of VueScan is not specific to a particular scanner brand and model. According to the user license, one installation of VueScan could be used with four different scanners, on four different computers, and with four different operating systems. Volume licenses are also available. VueScan is the most convenient and inexpensive scanning software to use for a variety of different scanners.

35mm film scanning

The model of 35mm scanner the author uses is the Nikon Coolscan II LS-30 (figure 4). This scanner works well in VueScan and has enough resolution for most 35mm scans. It is often bundled with the Nikon SA-20 automatic film transport accessory. The SA-20 is not recommended for Macintosh. The SA-20 works with Mac OS 9.1 and the original Macintosh NikonScan software. The SA-20 on a LS-30 and NikonScan does work well with an old version of Windows XP. Use the SA-21 slide adaptor with the FH-2 strip-film holder in VueScan for Macintosh.

To test an LS-30, first make sure the transport locking screws are removed. Then connect the LS-30 to a Macintosh or Windows PC with SCSI-2 cable. Check if the scanner is found using SCSI probe software available for free download on Adaptec.com (2016). Turn the termination switch on and then try again with the termination switch off, if the scanner is not found. Make sure the scanner is on when you boot your computer. If you make

A Nikon LS-30 scan from a Portra 35mm color negative of a classroom demonstration of a camera scanning back called the Phase One Studiokit. This camera scan back can also be used to scan film.

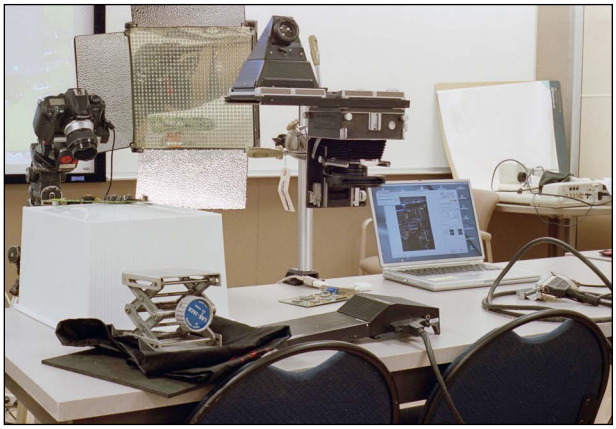

Figure 4

a change to your scanner such as the termination switch or SCSI ID number, make sure to reboot the computer to register the change. You can usually use any SCSI ID number except SCSI ID-0 on the oldest computers.

The next step is to launch VueScan and see if an LS-30 is found by the software. Vuescan can be downloaded as a trial to see if a used LS-30 is working. Do a test scan and if the scanner makes a very loud grinding noise turn it off. Leave the scanner on overnight and then try it again. If warming it up does not help, make sure the scanner is off and drop the scanner about one inch from a hard table. This often releases the scanner movement, which can get stuck with dried oil or lubricant.

If the scanner works after this, check scanned film for image quality. If the image quality looks poor like the image is "under water" open the scanner and clean the optical path. Search on-line for instructions on cleaning the optical path of a LS-30. There are a series of mirrors that can be cleaned in the LS-30 without disassembling the scanner. These mirrors often get dusty and coated with cooking grease. Pay special attention to the drive belt, which comes off easily. The LS-30 is a good scanner for color negatives.

The Nikon LS-30 works with black and white film but is not recommended. This is because the LED light source in the LS-30 makes film grain more visible than scanners with fluorescent light sources like the Polaroid Sprintscan 35 Plus. The Polaroid Sprintscan 35 Plus typically sold for $20–$50 in 2016. This scanner works well with VueScan (figure 5).

Make sure the film-strip adaptor is included with a Sprintscan 35. The motor and film-strip springs in Sprintscan 35 Plus's can be worn out. The film-strip path in a Sprintscan 35 is manually advanced. This is a good feature because there is one less moving part to malfunction. Polaroid scanners are made by Microtek, which is a current well-known scanner company. This is why the Polaroid branded scanners are a good value. Polaroid was associated with some poor quality electronic products since their trade name was sold. This tends to lower the auction price of the older Polaroid branded Sprintscan 35 Plus scanners. This scanner was originally $700 in 1998 and can produce good scans. It has enough resolution for most 35mm films.

Polaroid Sprintscan 120

The Polaroid Sprintscan 120 is a hard-to-find scanner (figure 6). This is because it is a Firewire scanner that does not need a SCSI interface. There is a Microtek branded model of the same scanner but the Polaroid branded version can sell for a lower cost ($350–$500 in 2016). The Sprintscan 120 has a motorized metal medium format film-strip carrier that can hold two to five frames of medium format film. You will need to set a frame offset

Scan of a Kentmiere 400 black and white 35mm negative on a Polaroid Sprintscan 35 Plus scanner. Lower cost films such as Kentmiere often have a bigger grain pattern. This grain is subdued with the fluorescent light source of the Sprintscan 35.

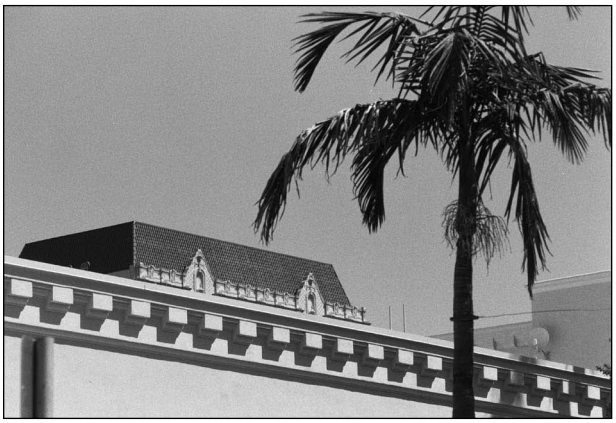

Figure 5

The dynamic range of a scanner is important with harshly lit subjects such as the photo on the left, which is lit from one 1000-watt tungsten spotlight. Low contrast negatives such as on the right are lit by an indirect light bounced off a white umbrella and have open shadows with much detail that is easy to scan with any scanner. Such flatly lit subjects are easy to scan but not very dramatic from an artistic perspective.

Figure 6

setting in VueScan such as "70mm" depending on the frame size of medium format camera you are using. This can be arrived at through trial and error and then keep the frame offset number the same for the same film size.

Polaroid Sprintscan 45 Ultra

The Polaroid Sprintscan 45 Ultra is a 4×5 inch large format SCSI scanner (figure 7). A SCSI-1 cable is needed to plug into a SCSI interface card or older Macintosh G3 computer. Some Sprintscan Ultra models have an older ROM that do not work well with VueScan. These older ROM scanners can be used with the original Polaroid Insight 4.5 or 5.0 software on Mac OS 9.2.2. Sometimes upgrade ROMs were sold on-line.

Insight is the original software that was bundled with the scanner. This software is available online but not from Polaroid. Using the scanner at 1200 dpi is sufficient for most 4×5-inch film stock and is much faster than the maximum resolution of 2400 DPI. A 2400 DPI scan can take a full half hour for one scan. A 1200 DPI scan is approximately eight minutes when scans are made on an 800mhz computer.

Lowering the dynamic range of a black and white negative is easy to do with film development techniques. This is a scan from a 4×5 negative that was massively overexposed and greatly underdeveloped. It contains both direct sun and dark wood paneling in full shade.

Figure 7

Minolta Multiscan

The Minolta Multiscan has just enough resolution for scanning medium format 6×6-cm ISO 400 speed black and white film stock (figure 8). It needs a SCSI-1 interface cable. It is a little low in resolution to match ISO 100 film stock, but adequate for many applications. If the scanner has not been used for a while the drive mechanism might be stuck. Make sure the drive screws are removed. If it does not go through a self-test routine with motor sounds when first plugged in, leave it plugged in for several days and then try it again.

The negative carrier masks do not work well with VueScan. Leave the masks off the negative carrier and VueScan works better with the Multiscan scanners. Flare from non-masked areas of the negative carrier was found not to impact the quality of scans.

Another example of overexposure and under developing a black and white negative with both sun and full shade. This time it is a scan of a 6×6cm negative on a Minolta-Multiscan scanner. This is an old scanner from 1998 without a great dynamic range but this was not a problem because compensation development techniques were used to fit the tones of the negative into the tones available for scanning. An older 50mm Ziess Distagon wide-angle lens was used on a Hasselblad. Both the lens and scanner do not have a great deal of resolution so they are well matched.

Figure 8

This scanner has a very long calibration routine in VueScan. Calibration only needs to be done when the scanner is first used and infrequently after this. Many consider the scanner broken because they did not wait (sometimes 4–5 minutes for initial calibration). If the negative carrier gets stuck, Mac OS will give a "Kernel panic" and then reboot the computer. Insert and eject the negative carrier several times if the scanner has not been used for a long time.

Computer hardware for SCSI scanning

An install of 32 bit Windows on a PC tower with a PCI SCSI card such as an Adaptec 2940U card works with many different SCSI scanners (especially on VueScan). ASPI is a useable but not currently supported software component needed for most SCSI scanners on Windows that can be downloaded from Adaptec. ASPI works best on older installs of Windows but can be made to work on newer 32 bit versions. If you are not using VueScan but the original software that was shipped with your SCSI scanner you will need to download and install ASPI (in most cases) to scan on Windows.

An old beige color G3 Power Macintosh tower with built-in SCSI is a rare but good choice for scanning. A Powerbook G3 Lombard laptop could also be a good solution but a special HD-130 SCSI adaptor is necessary. The best solution as far as portability would be a Powerbook G4 with an Adaptec 1480 Cardbus PCMCIA SCSI card. The driver software for the Adaptec cards are available for free download. For many scanners the original scanning software could be used on an older Mac with Mac OS 9.2.2. VueScan software could be used on Mac OS 10.4. for SCSI scanners. Old Macintosh operating system disks are easy to find on the used marketplace. Look for a retail install disks and not specific install disks that came bundled with a computer. Retail install disks can be used with a larger variety of computers.

The author's choice is a mirror door Macintosh G4 tower with a PCI Adaptec Powerdomain 2930CU. This computer will boot both Mac OS 10.4 and Mac OS 9.2.2. Use Mac OS 9.2.2 for the original manufacturer scanning software. To run scanner hardware Mac OS 9.2.2 must be a booting OS and not emulated on Mac OS10. The fastest SCSI system is a first generation single processor 1.6ghz G5 tower. The model number on the bottom of the 1.6 ghz G5 tower case should read A1047 EMC No. 1969. The Adaptec Powerdomain APD-29160 is backward compatible to SCSI-1 and SCSI-2 and would work in this G5 model. The G5 will only work with VueScan or Silverfast software since it will not boot Mac OS 9.

Conclusion

Film scanning is not always a substitute for a conventional wet darkroom. This is especially true for large format film sizes. Drum scanners that scan 4×5-inch and 8×10-inch inch or larger films are too big and heavy for most to consider. Older surplus drum scanners are so big they are palletized and a fork-lift is needed to move them. It is probably not hard to get one for free. Many of these old drum scanners only scan 8-bit. There are no new low-cost large format 4×5-inch dedicated film scanners such as the Sprintscan 45. Prints from 4×5-inch negatives or contact prints from 8×10-inch negatives from a wet darkroom can be scanned on low cost flat bed scanners to produce good quality scans.

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Steinhoff, S. (2009). Scanning negatives and slides: Digitizing your photographic archives. Santa Barbara: Rocky Nook.

This is an edited article

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