

How to Photograph a Painting using the Zig-Align System

Part V

Photographing Paintings, Historical Maps, Drawings, Posters

So you can print this art as Giclee

Based on work of Martha Martinez and David Frank Bujega (Malta Center for Restoration)
Introduction and editing by Nicholas Hellmuth





Caption for cover page: Canon Digital Rebel 35mm camera

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Introduction

This report is based on research accomplished by FLAAR at the Malta Centre for Restoration, University of Malta during 2003. This restoration center photographs hundred-year old oil paintings on canvas prior, during, and after restoring them. The center prides itself on their workmanship. Having photographs without visible distortion is one goal for meeting their standards of excellence.

Lack of distortion and lack of focus of the corners or edges of a rectangular object is even more desirable if you intend to reproduce a painting as a fine art giclee print. A giclee print of professional quality implies having the digitized version of the painting perfectly rectangular. Or else the image will be distorted when you print it.

David Frank Bujega wrote the original report on which this is based as part of this thesis or course project. Based on his report Martha Martinez, who had also done the original photography and worked with David the entire time during the set-up, organized the photographs into this present report. Nicholas Hellmuth took some of the photographs, added this introduction and occasional editing of the document, and described the equipment where appropriate.

We thank Bogen Photo, Calumet Photo, and BetterLight for providing certain items of the equipment.

This report is Part V of a multi-part set of documents on how to photograph paintings, historical maps, drawings, and posters so you can print this art as giclee.

- *Part I covers basic entry level cameras to record paintings for subsequent giclee printing.*
- Part II covers medium format cameras.
- Part III covers large format cameras.
- Part IV covers copy stands (for all sizes of camera)
- Part V covers the Zig-Align system for giclee photography with large format cameras.
- Part VI covers wide format scanners (which we do not recommend, but we added this report since full-page ads in trade magazines are showing this kind of scanner being used to produce giclee. We feel that people should be warned of the downsides).
- Part VII covers the dedicated (turnkey) Cruse reprographic camera, the professional system for a giclee atelier.

The Problem

We went to the Atlanta Deco Expo in 2004; it was held in the same huge Atlanta convention center as the Art Expo. Hundreds of giclee and fine art photographers and artists exhibited at these two trade shows in two adjacent halls.

In exhibit after exhibit I noticed that the giclee prints had problems with focus and depth of field. In every case I asked the painter who had done the photography. It was always “The best photographer in my city does the photographs of my paintings. He (or she) is very good.”

Maybe very good at portraits, or architecture, or commercial photography. But unfamiliar with the requirements for recording watercolor or oil paintings for reproducing as giclee.

One problem is that the photographer is not the same person who does the printing. So the photographer may never even notice how bad their photos of the painting are. But in this million-dollar art and décor trade show, the large majority of booths had paintings that were poorly photographed.

There were several exceptions:

- Several booths photographed by people who had the Cruse system
- The booth of Gary Kerr, who uses a Zig-align system.

Another exception was the booth of the Evolution Group, from Cleveland. These artists had BGSU+FLAAR do their photography (we use a Cruse and also have a Zig-Align+BetterLight system like Gary Kerr; one different system at each of our two universities).

The Cruse has a built-in alignment system; the Cruse is a turnkey system, already aligned from the factory. The BetterLight has the advantage of being portable, but the downside is that you have to align every painting individually. Most photographers don't take the time, or effort, or don't have the alignment equipment. Gary Kerr has the alignment equipment and takes the time to use it.

Since many photographers elsewhere have claimed they can take a perfectly aligned photograph on their own, with no special equipment, we decided to try this out. The result of course was a photograph clearly distorted at one corner. Even with a BetterLight tri-linear scanning back on a large format camera you can notice the distortion in the resulting photograph. This is not the fault of the BetterLight; this is the fault of the photographer not taking the time (or equipment) to line the camera up parallel with the painting. Of course if you are using a simple 35mm camera the result is not crisp enough to notice much distortion.

We then did tests using the Zig-Align system. After doing it once all the equipment was dismantled. A few days later everything was set up again and the experiment repeated. The overlap with the original photograph was remarkable. Plus naturally both were perfectly parallel with the film plane (or in this case, with the plane of the CCD sensor).

The Zig-Align system costs only a few hundred dollars, so there is not much excuse for not using it. The system we used was exclusively for 4x5 studio cameras. They have more costly models with lasers, or you can build your own laser. We used eyeballs; no laser.

Equipment for a professional giclee studio

- Backdrop material
- 1 tripod (such as Gitzo)
- 1 tripod head (Manfrotto)
- 4 X 5 (Cambo Ultima) camera and viewer
- ViewFinder 5.2.2 software for the BetterLight
- Laptop computer with SCSI (Mac PowerBook, Wallstreet model)
- SCSI connection
- Macbeth ColorChecker
- Sola Hevi-Duti line conditioner (only needed if you have line disturbance)
- Zig-Align mirror system
- Digital infrared filter (for either tungsten or daylight, depending on lighting)
- Adobe Photoshop version 6 or later
- 135mm apochromatic lens
- 2 lights (in this case Balcar fluorescent lights)
- Better Light 6000 Tri-linear scanning back with portability pack
- An easel (to hold the canvas or painting)



Equipment setup

Missing are polarizing filters for the lens and also for in front of the lights. These are needed to avoid highlights if you are photographing an actual oil painting. Since we were photographing raw canvas there was nothing shiny to catch a reflection. But if this had been a finished artist's canvas it would have required polarizers.

Accessories

- Bubble levels
- Rubber band to hold the filter on the inside back of the lens
- Focusing card, special focusing card from BetterLight
- Lens shade
- Extra battery for laptop computer



Lens, camera standard, bellow, bubble level, & Zig-align Mirror system

Setup of Photo Equipment

In this demonstration, the canvas was fixed to the easel¹. We recommend you use a backdrop material of a neutral color to make retouching in Adobe Photoshop easier.

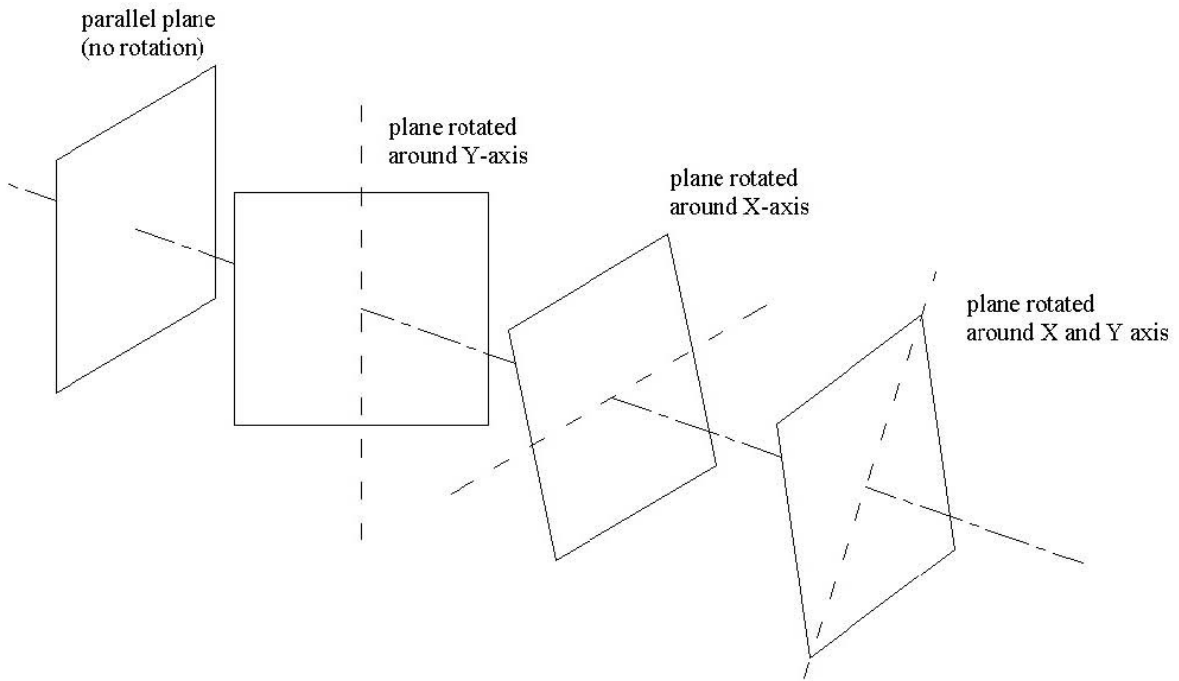
The tripod was positioned 1.5 meters away from the subject². The tripod head and the Cambo 4x5 were fixed to the tripod. The height and side shifting of the camera was adjusted until it reached the central part of the canvas³.

The fluorescent lights were both set at an angle of approximately 30° at each side of the subject⁴; at a distance of 2.5 meters away from the subject; and at a height that corresponds to the height of the central part of the subject.



Optical distortions were removed by aligning the camera to the plane corresponding to the canvas's surface. Considering that the camera utilized for this experiment is a large format camera, it was necessary to align its back and front standards⁵ too.

¹ The backward and forward tilting of the canvas was adjusted by the use of the easel. The tilt was checked repeatedly by a small 2-directional bubble level.
² The distance of 1.5meters was determined specifically for the size of the canvas and focal length of the lens. The canvas was viewed from the camera back while (the camera was) set at different distances away from the canvas-until the canvas was seen to fit well into the photographable area. Furthermore, the term 'subject' refers to the photographed canvas.
³ The central part of the canvas was found and marked. The vertical distance from the central part of the canvas to the ground was matched with the height of the camera lens. During the horizontal shifting of the camera, the canvas was viewed from the camera back (that includes a gridline). The moving adjustments were done until the center of the gridlines matched with the marked central part of the camera.
⁴ The lights were set at different angles and distances away from the subject, until reaching an even lighting-that was neither too strong (resulting in overexposure), nor too weak (resulting in underexposure).
⁵ The term "standards" refer to the back and frontal part of the camera. They are both attached to the bellows.



Parallelism of two (or more) planes, involves in rotating the plane/s around the Y-axis; X-axis; and XY-axis.



David, Nicholas, and one of the many staff of MCR, Malta.



Zig-Align mirror system and lensboard before setup

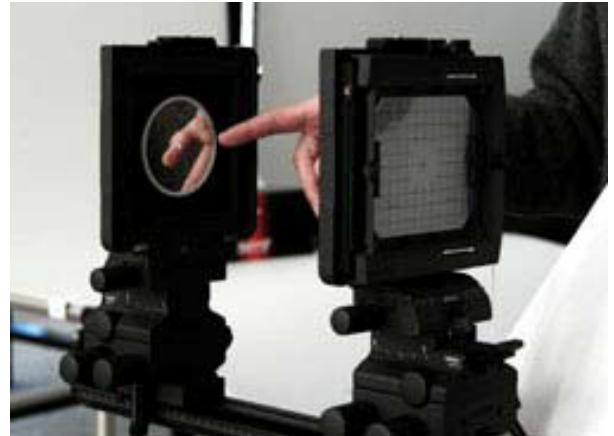
Alignment of the two camera standards were done by the Zig-Align mirror system. With the use of this system, it was possible to obtain the two planes set parallel to each other. This assured that no 3-D planar distortions of the subject will be present in the photograph.

Aligning the camera standards with the Zig-Align

The first step consisted of adjusting the front and back standard to be set at the same height and X-axis shift. The subject was then focused by attaching the bellows and the lens. Focusing was done by altering the distance between the two standards.

The bellows and the lens then had to be removed. The rectangular mirror, having the same measurements of the negative film, was inserted into the back standard of the camera. The circular mirror was then attached to the lensboard holder. The reflective surfaces of both mirrors were positioned facing the inner side of the camera.

The circular mirror features a small hole from which the operator could see through. By doing so, the rectangular mirror (placed on the other side) could be seen. This observation makes it possible to see a reflected image of the circular mirror on the rectangular mirror. This reflection is manifested with a circle-that corresponds to the circular border of the mirror.



Circular mirror attached to the lensboard

The distance in between the two mirrors is seen as being doubled by an optical illusion of depth. This causes the circular border to seem smaller than it actually is. Because of this property, each time the circle outline is reflected from one mirror to another, the circle optically doubles the actual distance, appearing smaller and smaller, until reaching an infinite distance (in which the circular border appears as a single dot). In doing so, the reflected images of circles that diminish in their size, provides visual information to whether or not the two planes (of the mirrors) are in a parallel position with each other.



David aligning the camera standards with the Zig-Align

This checking is done by observing if each circular reflective image has its respective diminishing image located flanking its inner border.

If the diminishing images of the circular shapes are not directed towards the central part of the biggest reflective image (first reflection of the circular mirror), then the two planes are not set parallel.

For this reason, the front standard needs to be tilted along the X-axis; Y-axis; and XY-axis until the reflected images are observed to be perfectly centred.

Aligning the subject's flat surface with the two camera standards

The Zig-Align system and the gridline (present in the viewfinder of the camera) were utilized for the alignment of the camera standards with the subject's flat surface.

Firstly, the same rectangular mirror as used in the back standard was moved and hung with the use of the nylon string attached to it. The reflective surface was set facing the photographic camera. Positioning of the mirror was done in such a way that its central part corresponded with that of the subject.

It was made sure that the whole (non-reflective) surface of the mirror was in contact with the subject's surface. This was done to ensure that the mirror and the subject's surfaces are set on the same plane.



Rectangular mirror being hanged with the use of the nylon string attached to it.



Mirror-to-mirror reflections being again observed through its hole.

Both the lens and the viewfinder were removed from the standards of the camera. The circular mirror was attached to the back standard of the camera and the mirror-to-mirror reflections were again observed through its hole. The same system utilized (for the alignment of the two standards) were again utilized for the planar alignment of the canvas surface with the standards. This method is an improvised alteration of the Zig-Align. For this second alignment, it was necessary to align the standards with the subject only with the use of the tripod head. This was done in order to alter the positioning of both standards contemporarily. By doing so, the previous alignment of the standards was maintained.

Procedure for taking a photo

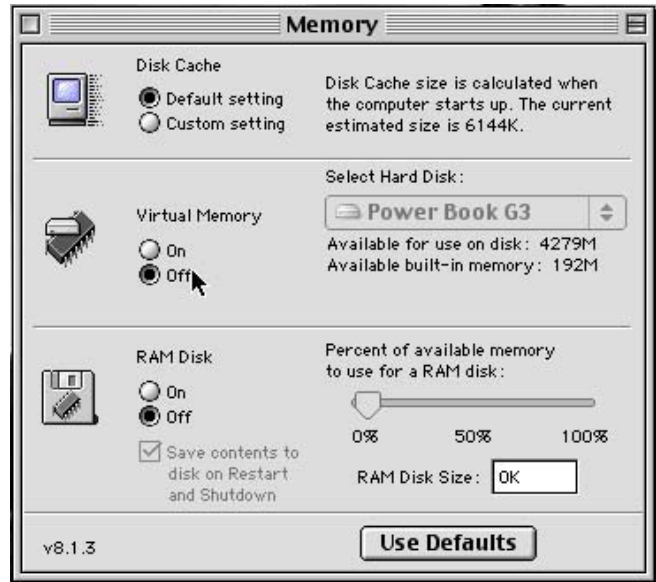
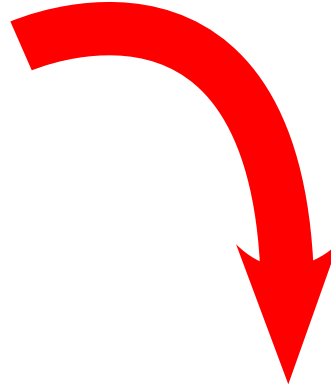
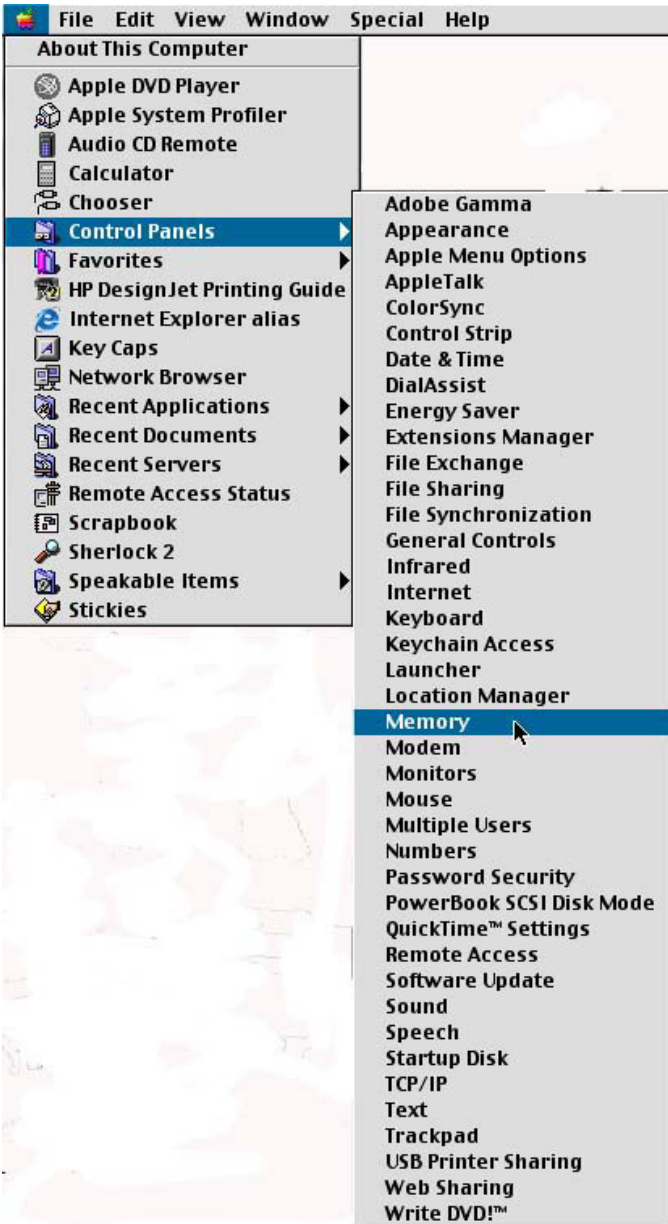
1. Remove the mirrors from the subject and camera after the three planes are aligned.
2. Insert the lens and attach the square infrared filter to the back of the lens with a rubber band or Gaffer tape. It is absolutely necessary to use the infrared filter with most kinds of lights.
3. Manually focus on the subject. You will first have to set the camera dials to zero. Then start moving them while looking through the viewfinder of the camera until the image is focused. If you are photographing a three-dimensional scene, try to focus on an area 1/3 into the object. That way depth of field results in the front and halfway to the back to be in focus in most instances.

4. Connect the BetterLight digital system with its cable to the computer.
5. Insert the scan back.
6. Turn on the BetterLight system.

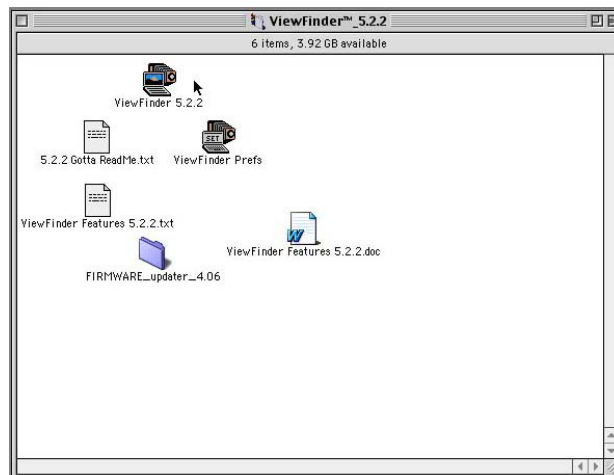


The green light indicates, that you are connected to the main external power. The yellow light means that your battery is still charging, but you can use the system. The system is turned on fully when the red light is on.

7. Turn on the computer.
8. If you have not done so previously, turn off the virtual memory of the computer, and restart. To turn off the memory open the *Control panels* and select *Memory*



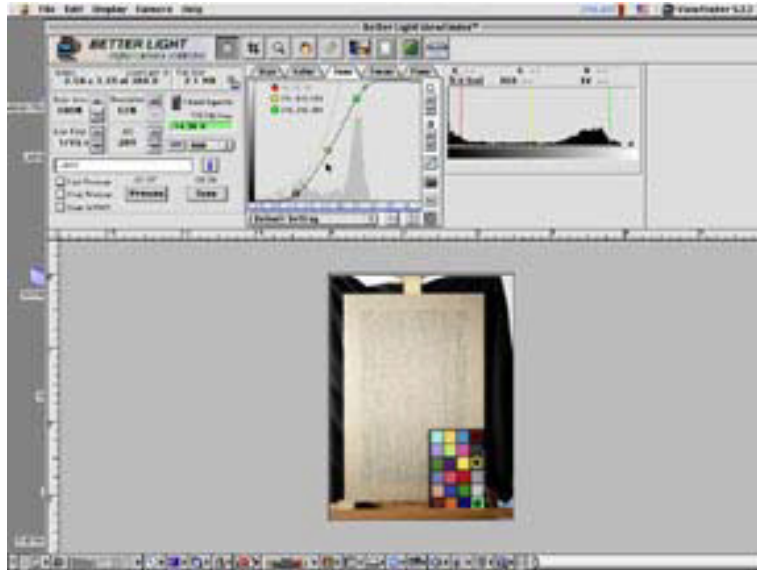
9. Open the ViewFinder software by clicking on the icon.
We are using the ViewFinder 5.2.2 software.



10. Choose a low resolution for the Prescan (12%).

11. Choose a line time and ISO.

The line time is the digital equivalent of the shutter time. The line time and aperture of the lens determine the exposure. Under *Preferences* you can choose how it operates (exact, 60Hz, 50Hz⁶).



The longer the line time (e.g. 1/8s, 1/15s), the more light can be absorbed by the CCD. But a longer line time also increases the scan time and the dark current noise.

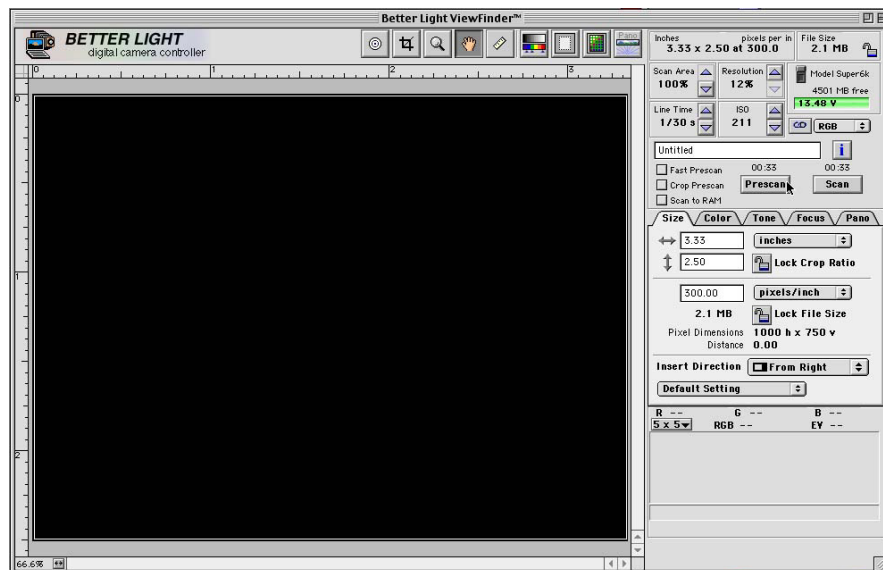
ISO determines the sensitivity of the camera. With a higher ISO the shadow noise increases.

A faster line time needs a higher ISO. You can synchronize the two settings by clicking on the small button next to the ISO field.

Also, adjust the aperture of the camera if your prescan appears to be over- or underexposed.

12. Turn off any ceiling or other additional lights.

13. Take a prescan.



⁶ 50 vs. 60 Hz have to do with the electrical line frequency. Comments will follow once we have gained some experience with this.

14. Balance grays with a Gretag MacBeth ColorChecker.

Put the ColorChecker within the scan area and prescan. Then open the *Color* panel, and select a gray with the *Spot Meter* tool.



Spot meter

It is important that the three readings for each gray are equal. Click on *Auto Balance*. Observe changes to the histogram and the preview image. *Revert* and *Clear Meter* until you get a satisfying histogram. A good histogram has an even distribution of peaks over the whole width of the graph.

You might have to choose different shades of gray to balance the overall color. The program allows for four shades of gray to be chosen at the same time.

For better contrast, and to capture details in shadows and highlights, you might want to choose the black, middle gray, and white fields. Click on *Auto Balance*, and then adjust the readings for the black to about 25 by changing the line time and ISO settings.



The gray balance is important because it corrects the colors of an image to produce a color realistic photo. Gray is a neutral color that possesses all wavelengths of light in equal amounts. Thus, by balancing the grays, i.e. eliminating any irregularities in its wavelengths, all other colors will be balanced as well.

The histogram should peak roughly in the middle of the chart. Both piedmonts of the histogram hill should be well inside the chart. If any edge of the base of the hill is touching either edge of the chart then you are either underexposed (far to the left) or overexposed (far to the right).

The more corrections you make in the camera software, the less you will have to correct the image in Adobe Photoshop later on.

You can make changes to the contrast range with the tone panel. The panels on the right of the graph have the following functions:

- i. Increase/decrease brightness
- ii. Increase/decrease contrast
- iii. Choose between 5 or 7 control points
- iv. Negative

The three buttons at the bottom of the graph control the range of manual adjustment allowed for the curve control points.

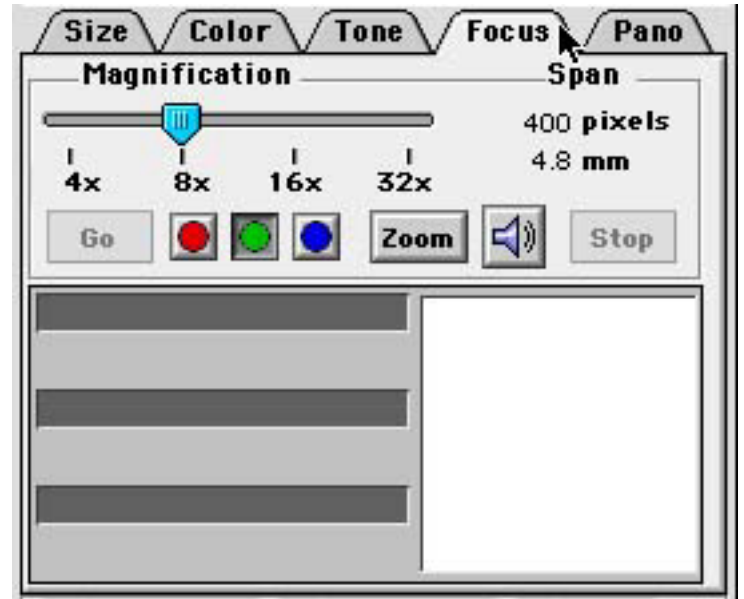
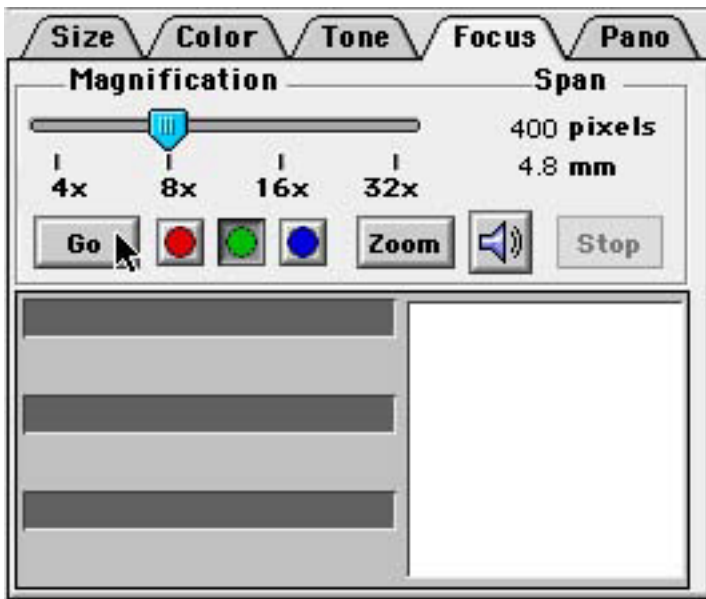
If you have selected a black, middle gray and white, you will first have to move the circles into the middle of the colored fields. When you are using 5 handles, use the middle 3 circles. For 7 handles, use the 2nd, 4th and 6th circle.



Then click on the Vertical Move button to locate the exact output density, and to keep the circle inside the square.

Drag the square corresponding to the black to a value of 25, the middle gray to 120, and the white to 240. This is how our crew interpreted the camera software instructions. But I prefer to increase or decrease the lighting, line time, or ISO, and not mess with wrenching the curves. The white point, black point, and resulting curves will fall naturally in place if the lighting is good to begin with.

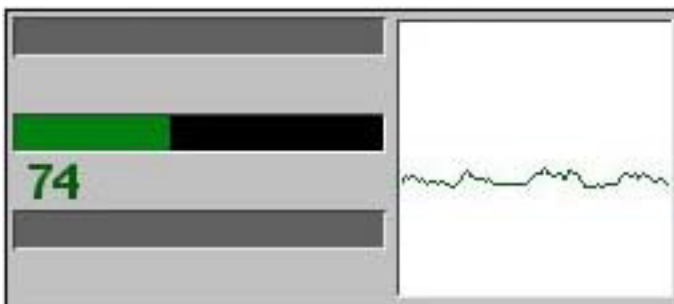
15. Focus.



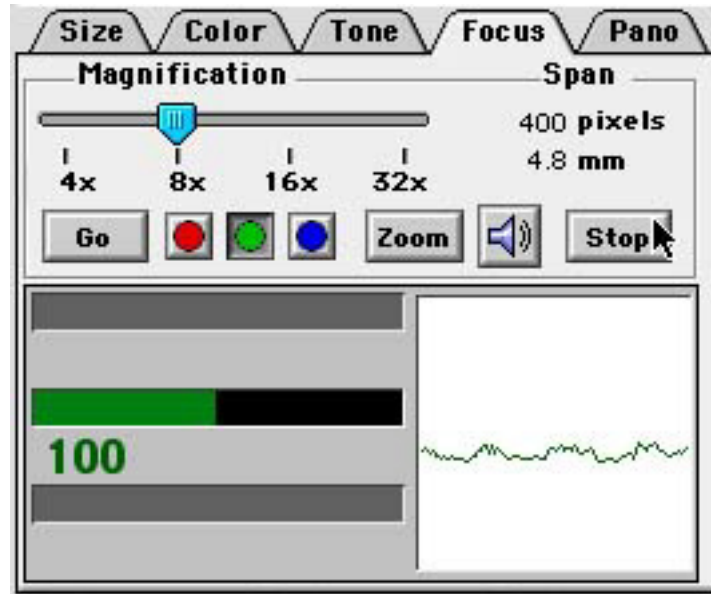
Open the *Focus* panel.

Select the area of the image where you want to accomplish better focus and click on *Go* (digital focus on non-flat objects is also best done at about 1/3 into the object, and not at the center).

A horizontal bar and a number will come up.



Turn the dials on the camera until you have reached the highest number. There is no ideal number. Then click on *Stop*.



It is usual to focus only on the green channel. If you can't get a proper focus you might have to manually focus again. Keep in mind that inserting the scan back or changing the aperture might change the focus slightly due to camera movements.

16. Prescan until you get a satisfying result.

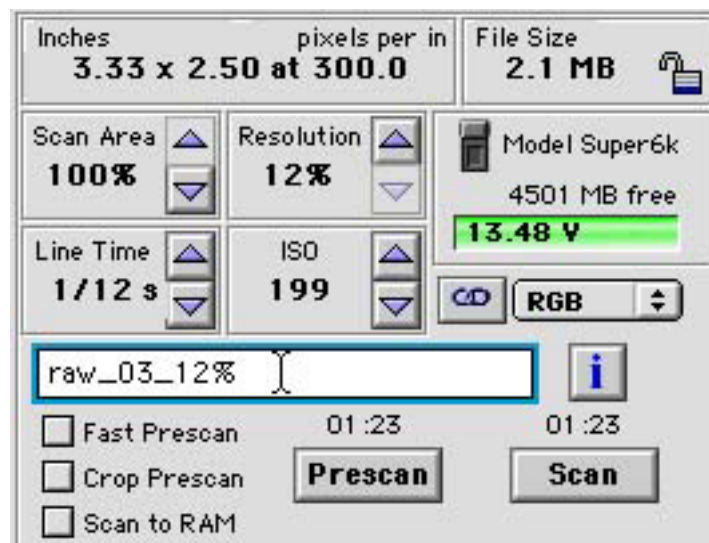
It might be helpful to take notes of the final settings for future reference. You can do that under *File, Save Settings*.

17. Choose 12% resolution for the scan⁷.

Choose the resolution according to the purpose of the photograph.

18. Choose a name for the photograph

You can also add additional information by clicking on the "i" icon next to the scan option.

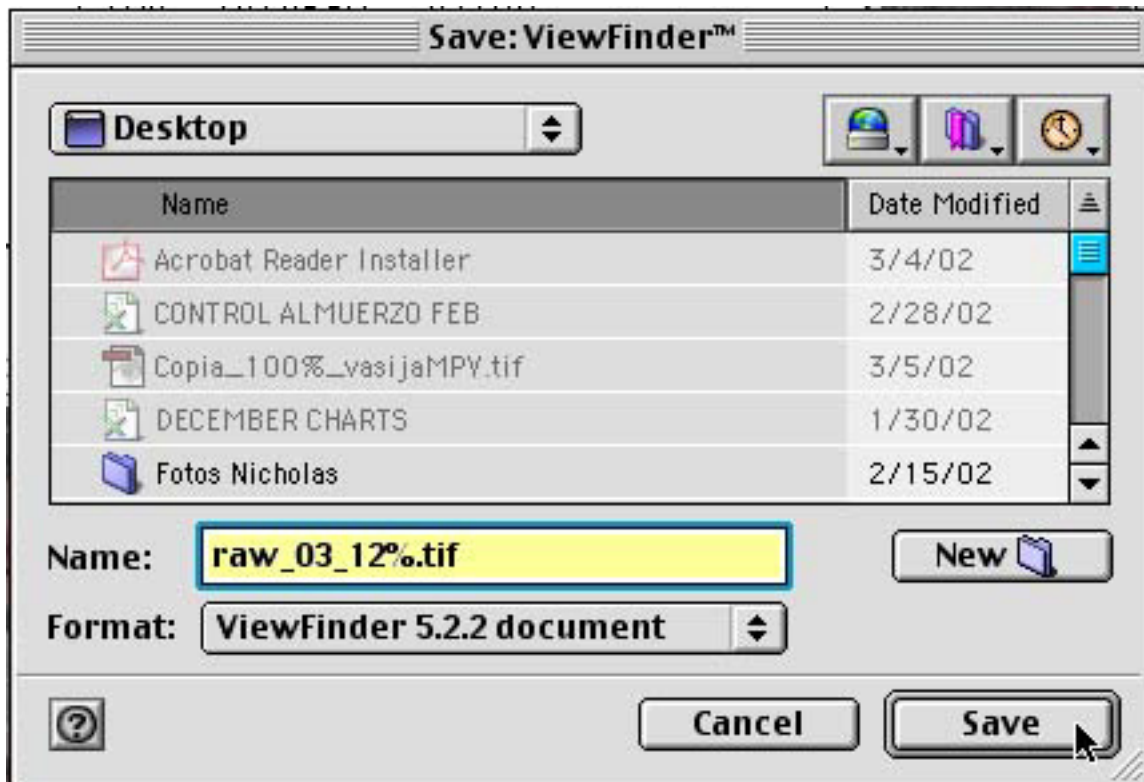


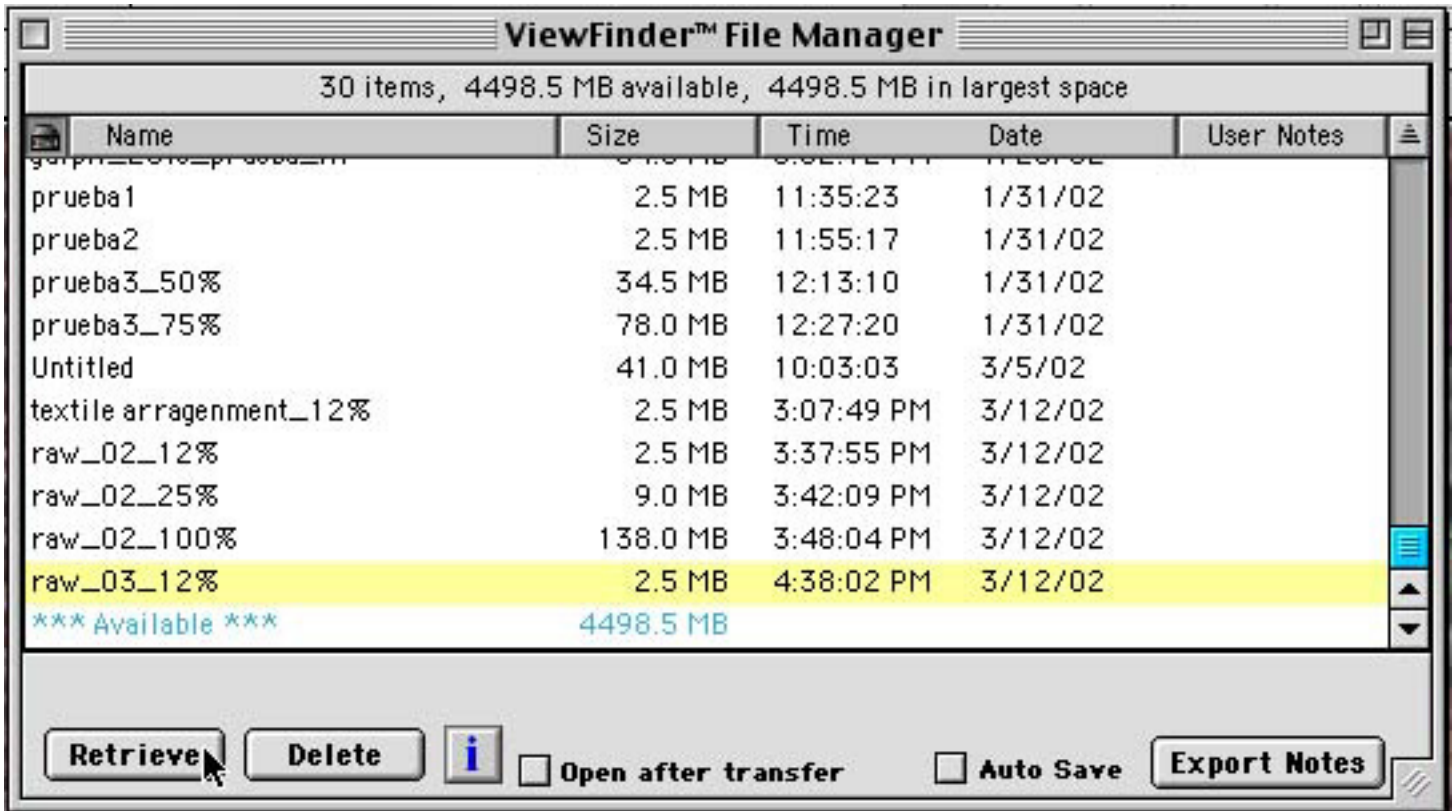
⁷ Do not take photographs larger than you need. Dye sub and digital imagers need about 300 dpi. Piezo printers with 1440 dpi may want 240 to 300 dpi. Most thermal inkjet printers, such as Encad, HP, and ColorSpan only need 150 dpi. Sometimes 120 dpi might be enough for a thermal printer.

19. Scan.



20. Open the *File Manager*, and retrieve the image.





21. Open the picture in Adobe Photoshop.

22. If you wish to take another shot of the same object, be sure to change the name of the file to prevent erasing one of the shots by mistake.

Precautions

1. *The lux level of both light sources may need to be maintained constant with the use of an electricity stabiliser. Depending on the situation in your area, stabilization may be fundamental during the shooting of the photographs since gaps of colour and definition errors could result by luminosity fluctuations.*
2. *Repeated checks were done to ensure that the alignment was correct. This was done by repeated observations of the mirror reflections.*
3. *After that each planar alignment was done, careful attention was given during attachment and removal of lens, digital scanning back, bellows, (etc.), in order not to accidentally alter the positioning of the standards and that of the subject.*

Appendix A Actual-Factual Comments on Use of Zig-Align in a Giclee Studio

Gary T. Kerr

Fine Art Impressions Charlotte

Introduction and Photographs by Nicholas Hellmuth

Introduction

I visited the atelier of Gary Kerr two years ago. He successfully uses the BetterLight Super 6K digital scanning back with a 4x5 camera. His prints are accomplished with an Epson 10000 from Parrot Digigraphic. For color management he is using Monaco software combined with ErgoSoft RIP.

Experience of Gary Kerr, Fine Art Impressions

The Ziegler's Zig-align system was an ingenious invention to address the concerns of parallelism for photographing paintings for fine art reproduction. Once you have the process down, it is possible to eliminate all concerns for distortion and soft-focused issues.

The purpose of using the Zig-align system is to achieve parallelism between the subject plane, lens plane, and film plane. If any of these are compromised, you will introduce distortion to the image – even if undetectable on the ground glass. Our studio prefers a horizontal copy arrangement using a large format view camera and digital scanning back.

Different size paintings will require that you move your camera to compose the image properly on the ground glass. Therefore, you normally need to re-Zig-align with any movement of the camera stand, or tripod. The Zig-align process must be the final step prior to photographing the painting. This is to prevent anything from moving after the Zig-alignment is completed which is imperative to maintain parallelism between the three planes. Fixed or rigid copy set-ups do not have this drawback, however, they have other drawbacks our studio would not accept.

We Zig-align our view camera to a custom-built, wall-mounted magnetic copy board by aligning the film plane (rear standard) to the copy board first. We then align the lens plane (front standard) to the film plane resulting in three parallel planes. After completing the Zig-alignment, we take down the mirror, and re-mount the artwork.

Since this process is time consuming and requires mounting the artwork twice (once to compose on the ground glass, and once to allow the mounting of the Zig-align mirror), we added fixed lasers to our camera stand enabling us to re-Zig-align our system *periodically*, instead of with every new painting we photograph. Hence, our horizontal system with fixed lasers now enables us to hang paintings once, compose on the ground glass, and re-Zig-align the whole system in five seconds without having to remount the artwork. This is achieved by using our custom lasers set up as guides to re-establish fixed points of the camera alignment previously established by the Zig-align system.

Whatever set up or process you use, achieving absolute parallelism cannot be compromised if you want to create convincing fine art reproductions. If you only occasionally photograph paintings, the fixed laser set up is not necessary, but if you photograph paintings all day long, the Zig-align system with the added lasers provides a platform for consistently achieving parallelism without compromising productivity – especially for horizontal copy set-ups. The laser set up we use is not sold with the Zig-align kit, we developed the system of fixed laser for use with the standard three-mirror Zig-align system. The Zig-align is available in a version with LEDs, but this does not eliminate the step of mounting the mirror on the subject plane which is what distinguishes our fixed laser set up.

Gary Kerr is founder of Fine Art Impressions, a fine art printmaker in the Charlotte area specializing in photographing and reproducing oil paintings. His photography and printmaking standards are among the highest in the industry. Fine Art Impressions serves the fine art trade and museums internationally and can be reached at 1 800 419-4442, info@FineArtGiclee.com, www.FineArtGiclee.com.



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