Nikon

Software Reference for Scanners

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Acknowledgments

Nikon Inc. acknowledges with gratitude the contributions of the Planning and Design Sections, and the Electronic Imaging Department Software Engineering Section. These manuals were written, designed and produced by the Electronic Imaging Department Development & Marketing Group in collaboration with the Technical Support Section and the 4th Designing Section of Nikon Corporation. Nikon would also like to thank all those who helped test the LS-3510AF and its software.

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Read This First

About This Manual

This reference and disk set contains material for either Apple Macintosh computers or PC compatibles running MS Windows. Where possible, we have tried to make both versions of software as similar as possible in feature set and interface design. There may be occasions, because of operating system dissimilarities, where the two versions may not match exactly. The explanations in the respective platform sections may also differ for that reason.

Commands that are taken from the user interface are shown using Helvetica type. Cautions and Notes are printed in **boldfaced** type with a triangular marker in the margin.

The Package Contents

Listed below are the components of the Nikon Software Reference for Scanners package.

- Nikon Software Reference for Scanners
- Nikon Device Drivers Disks for Macintosh and Windows 3.0
- Nikon User Registration

If any of the above are missing, please contact your Nikon Electronic Imaging Dealer immediately.

User Registration

If you would like to receive the latest information and updates from Nikon, please fill in the User Registration and mail it today!

Minimum Macintosh Scanning System Requirements

- Macintosh System 6.0.5 or later
- 32-Bit Quickdraw
- 4MB RAM (8MB recommended)
- 80MB Hard Disk (300MB recommended)
- National Instruments NB-GPIB card with cable when using the GPIB interface

• SCSI II cable adapter when using the LS-3510AF SCSI interface

• 8-bit display (24-bit true-color display highly recommended)

Minimum PC and Compatibles Scanning System Requirements

• Windows 3.0 or later

• 4MB RAM (8MB recommended)

• 80MB Hard Disk (300MB recommended)

• National Instruments GPIB -AT (for ISA bus) or MC-GPIB (for Microchannel bus) card with cable when using the GPIB interface

• SCSI II cable adapter when using the SCSI interface

• Super VGA display (24-bit true-color display highly recommended)

Before You Begin

Before you begin setting up, make a backup copy of your master diskettes! Put away the masters in a safe place and work with the backup copies to install the Nikon Drivers.

Please begin by following the Software Installation procedures for your particular platform.

The Getting Started section of this manual will get you up and running in the shortest possible time. This is a condensed instruction manual that will lead you through the basic steps of scanner setup, configuration, and finally, scanning of the enclosed sample slide. Don’t worry if you don’t fully understand some of the terminology and concepts we are introducing here. The idea is to setup quickly and familiarize yourself with the controls by performing a routine scan.

You will probably require one hour to perform any hardware installation, test it, and go through a trial run. In this time you will gain a working knowledge of the scanning system. Before you begin, make sure that you have the minimum system requirements for a functional scanning system.

In particular, if you are using your scanner with a GPIB interface, you must have a GPIB interface card installed in your computer, or have one ready to install. For a thorough explanation of scanner controls, color imaging techniques and color separation guidelines, we strongly recommend reading the User's Guide sections of this manual.

For detailed information on the scanning hardware and a full discussion of programming your own scanner control interface, refer to the Technical and Programmer's References available from Nikon. Now, let’s begin....

Software Installation

Installing the Plugin Modules on the Macintosh

If you have not already done so, install Photoshop following Adobe's installation procedure. If you are using ColorStudio, then follow the installation routine specified by Letraset.

After you have installed and tested your image processing application, you are ready to install the Nikon Plugin modules. If you are using Photoshop v 2.0, they should be placed in the Photoshop Plugins folder within the Adobe Photoshop application folder. If you are using ColorStudio or another image processing application that uses Photoshop Plugins, install the module in the location specified for plugins by the manufacturer of the software package.

>Note **This plugin works with Photoshop 1.0 or later, or ColorStudio 1.5 or later. You must update older versions with the new ones before you use this software**

Start your Macintosh and determine if you are running System 6.0.5 or a later version. If you are unfamiliar with how to do this, please refer to the Macintosh Owner’s Guide. Insert your backup Nikon Drivers disk into the drive. The disk icon will appear on your desktop and three windows containing folders will appear in a vertical column on the left side of your screen, as shown below.

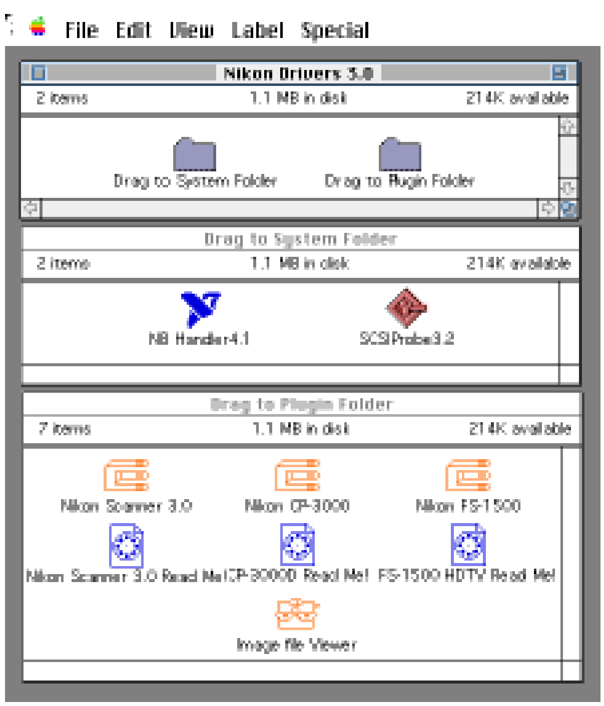

Fig. 1 Desktop

If you are using a GPIB interface, select the NB Handler Init in the folder labeled Drag to System Folder and drag it onto the System Folder on your hard disk. It will be copied into the Control Panels folder if you are using System 7.

>Caution **If you already have a file called NB-Handler INIT installed in your system folder, move it to another folder before you copy the new file in.**

Next, drag the Nikon Drivers disk icon onto your hard disk icon and follow the prompts. Double click on your hard disk icon to reveal its contents. Now double click on the Nikon Drivers folder to display the NB Handler Init, the plugin modules, and the ReadMe documents.

If you are using the built-in SCSI interface on the Macintosh, connect the DB25 to SCSI II cable adapter to the rear panel connector on the Mac and then to the Mini 50 pin connector on the Nikon scanner. If this is the only unit on the SCSI bus, connect a terminator to the second plug on the scanner. Restart your Macintosh and go on to Using the Plugin Scanning Module.

Configuring and Testing the GPIB

If you are using an NB-GPIB interface card, the NB Handler Init *must* be in your startup (boot) disk's System Folder in order for the plugins to work properly. Using System 7, it should be in the Control Panels folder.

In order for the NB-GPIB interface to communicate properly with the Nikon Plugins, the NB Handler control panel should be configured to your device address settings. In particular, it is necessary that the GPIB finds a device called LS-3510AF, which is the LS-3510AF Film Scanner (or in the case of the LS-3500 scanner, LS3500), when the plugin looks for it. Similarly, if you are using a CP-3000 printer, then the name CP-3000 must be used by the NB Handler to indicate the device. If your NB Handler does not have your scanner or printer address configured properly, the GPIB may not communicate with the device connected.

If you have an old version of the handler in your system folder, remove it temporarily and replace it with the new version from the Nikon Drivers disk. This is a preconfigured file for the Nikon LS-3500, LS-3510AF, CP-3000D and FS-1500 devices. Using this Init will get you running in the least amount of time and you can reconfigure for other devices later on. If you are using the preconfigured NB Handler, confirm its correct installation by restarting your machine and opening your NB Handler control panel from your Control Panels under the Apple Menu.

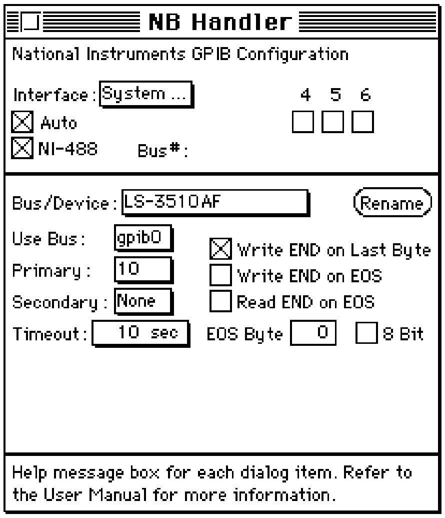

Fig. 2 NB Handler control panel

Check to see that the addresses are correctly entered and conform to the factory default settings of the device DIP switches. If so, proceed to the next section, Using The Macintosh Plugin Scanning Module.

If you wish to change the configuration, use the rename button to change any devx setting to the appropriate name of the device. Set the address in the text-edit box labeled Primary. It is not necessary to restart your machine for the changes to take effect. Simply close the Control Panel and go on to Getting Started.

>Note **If you have an older NB Handler Init installed it may not be of the control panel type and will not show up in your Control Panels folder. If so, you can use the IBCONF utility usually supplied with your National Instruments NB-GPIB board to add the Nikon configuration to your old Init, or you can modify the new one with the control panel shown above to include your other devices, such as film recorders and other scanners.**

Installing the Plugin Modules under Windows 3.1

If you have not already done so, install PhotoStyler following Aldus' installation procedure. If you are using another application, then follow the installation routine specified by the manufacturer.

After you have installed and tested your image processing application, you are ready to install the Nikon Plugin modules. If you are using PhotoStyler they should be placed in the PhotoStyler directory.

>Note **This plugin works with PhotoStyler 1.0 or later**

Launch Windows. If you are unfamiliar with how to do this, please refer to the Microsoft Windows Owners Guide.

Insert your backup Nikon Installer Disk in your floppy drive - drive A: for example.

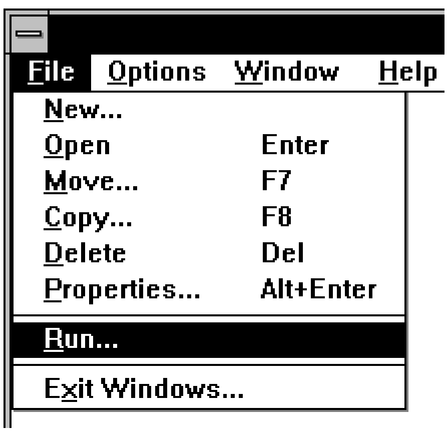

Fig. 3· The Program Manager File Menu

Select Run... from the File menu in the Program Manager.

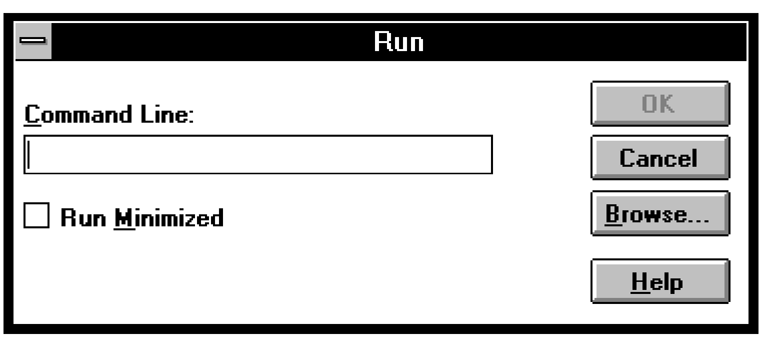

Fig. 4 The Run... Dialog

Type A:PSSETUP and press enter. Press any key or click the mouse to skip the startup screen.

Fig. 5 PhotoStyler Directories

Enter your source and target directories. To install only the Scanner Plugin or the Nikon CP-3000 printer export, check the Update box before pressing the OK button. Choosing Setup All will install all the plugins on the disk.

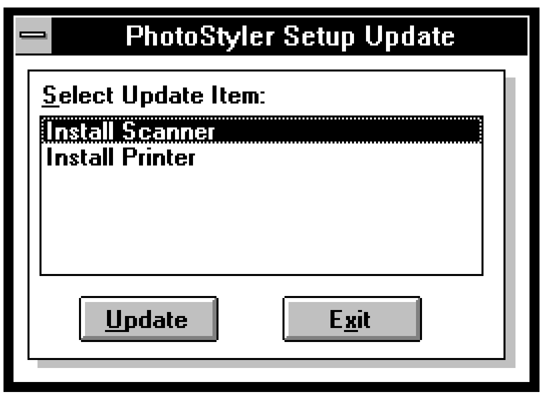

Fig 6 Installing the scanner

If you are updating the scanner, choose the Install Scanner selection.

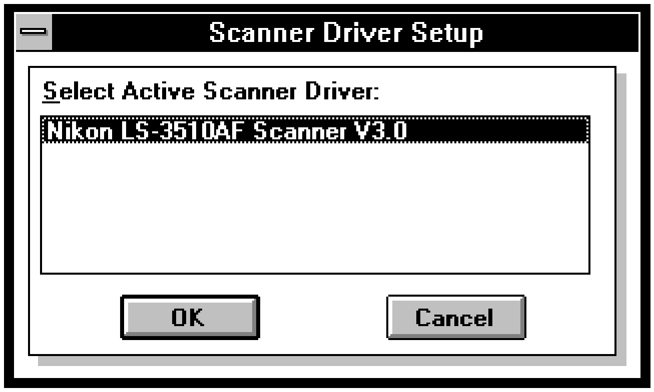

Fig. 7 Selecting the active scanner for PhotoStyler

You must choose which scanner driver to make active in PhotoStyler. Since only one driver is available, click OK.

Your drivers are now installed and you can proceed on to the Getting Started section for the Windows plugins.

Interface Hardware for PC Compatibles

For complete information on installation of GPIB hardware consult your GPIB installation manual which comes with your GPIB board.

As with any interface board installation, ensure that there are no address, interrupt or DMA channel conflicts between any boards installed in your computer.

GPIB (General Purpose Interface Bus)

Currently, only the National Instruments AT-GPIB and MC-GPIB boards are supported. When installing the software drivers for these boards, be sure to select the installation for Windows. National Instruments can be reached at 1-800-IEEE-488 (1-800-433-3488).

SCSI (Small Computer Systems Interface)

Any SCSI board with ASPI (Advanced SCSI Programming Interface) drivers should work, but only the T128 and T228 from Trantor and the AHA-1520, AHA-1522, AHA-1540B, AHA-1542B, AHA-1640 and AHA-1642 from Adaptec have been verified. Trantor can be reached at 1-510-770-1400 and Adaptec can be reached at 1-800-869-8883. The ASPI drivers may not be included with the standard software bundle and may have to be specifically requested.

Getting Started on the Macintosh

Launching the Application

Launch Photoshop or ColorStudio by double clicking the appropriate icon.

Pull down the File menu to reach the Acquire... menu item and select Nikon Scanner... from the hierarchical menu. The main scanning dialog will appear as below and the Device: and Address: lines should indicate that there is a scanner connected. If the dialog appears as below, you are ready to start scanning and can proceed to Scanning a Preview Image.

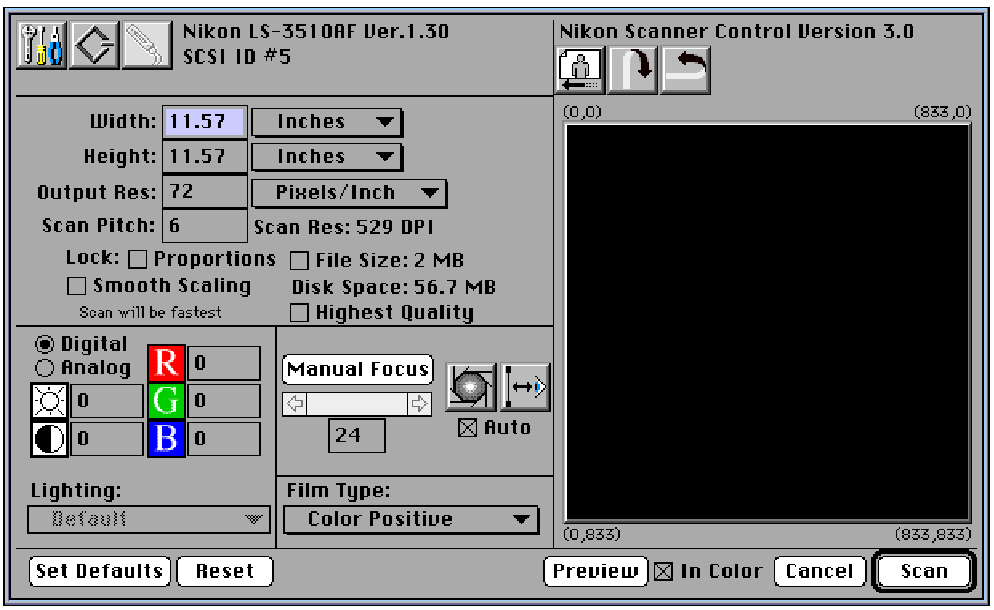

Fig. 8 Main Scanning Dialog

If the message in the upper left-hand corner reads “Nikon LS-3510AF Ver 1.xx” on either a SCSI or GPIB interface, you are ready to make a preview or scan. If not, the plugin has not found the scanner and you will need to check your SCSI or GPIB cabling, confirm tight connections and proper termination. For SCSI installations with other external devices, place the scanner at the end of the chain with the standard supplied terminator for your machine. If you are unsure what GPIB or SCSI address to use, consult the Setup Guide included with your scanner.

Scanning a Preview Image

Take out the sample slide included in the disk holder. You will be using the Standard Slide Holder for this scan. Hold the mount as in the diagram in *Fig. 9* below. Insert the slide so that the emulsion side of the film faces the front of the scanner. When viewing the slide orient the picture so the text is readable. The emulsion side is the surface furthest away from you. Since the LS-3510AF is an autofocus scanner, it will not make much difference which way you place the emulsion (other than image orientation, right-reading or backwards), although sharpest results will be achieved when the emulsion faces the front of the scanner because the imaging lens will not be reading the film through the film base, which may reduce definition, depending on the film type.

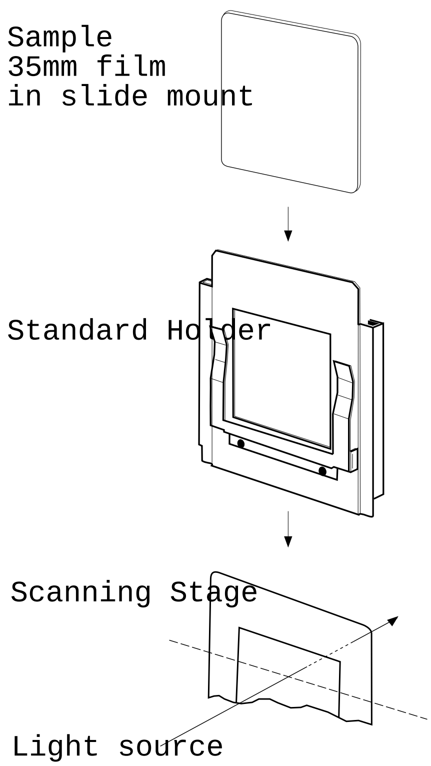

Fig. 9 Loading the Scanner

Insert the Slide Holder into the scanner so that the slide mount is closest to the lamp. Close the dustproof cover so that the outside light does not affect the scan.

The sample slide is a portrait (or a vertical image) but we will leave the default scanning orientation in the horizontal or landscape position.

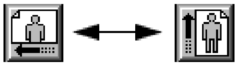

Fig. 10 Orientation

The quickest way to capture this image is to click the Preview button.

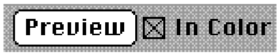

Fig. 11 Previewing an Image

In order to scan the slide under optimal conditions, the LS-3510AF will first perform an autoexposure and autofocus sequence to determine information about the nature of the image in the holder.

You should see the green *Busy* LED light up on the scanner and a message appear in a small dialog. The message should read Performing an autoexposure... This status line will keep you informed about the scanner's progress.

When the green *Busy* LED on the LS-3510AF goes out, you have completed the Autoexposure cycle and the scanner will automatically focus on the slide displaying the message, Performing autofocus... After this, the *Busy* LED will immediately light up again and the scanner will begin the preview cycle as it reads the picture directly to your monitor display, field by field. We can now see the image appearing on the video screen in the scan window in the sequence red, green, then blue screens.

>Note **You will not be able to see the high-quality color available from the scanner unless you have a 24-bit display card installed in your system. Using an 8-bit card will display a dithered image.**

Final Scan

The next step will be to perform the main scan at a higher resolution. Crop the preview image by placing the cursor at any corner of the preview, and dragging to enclose the area of interest in a rectangle as in *Fig. 12* below.

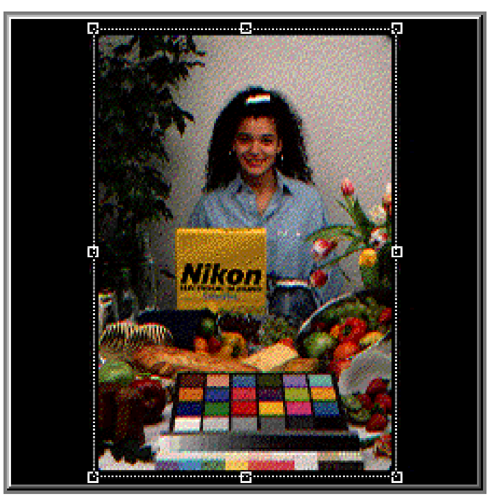

Fig. 12 Cropping the Preview Image

The resolution setting under the preview window can be left at the default setting of 72DPI. The approximate size of the output image should be 6 x 8 inches.

You are now ready to complete the final scan. Click on the scan button at the lower right of the Main dialog. The scanner will begin the scanning cycle, making three successive passes for red, green and blue. Within a moment or two, a progress indicator dialog will appear, showing the approximate duration of the scan and the portion remaining to be completed.

Fig. 13 Scanning Progress Indicator

Be sure not to open the dust cover during the scan. If it *is* opened, extraneous light could adversely affect your scan and cause density changes to appear in the image. This scan will take approximately 45 seconds to complete. A new window containing the image and labeled Untitled-1 will appear after the scan is complete. You may save the image in the normal manner or close the window and begin again.

Conclusion

You have completed Getting Started! Feel free to continue exploring on your own, but if you need quick answers to any questions, don’t hesitate to consult the User's Guide following this section. It provides complete descriptions of the plugin controls so you can exploit the full functionality of your Nikon scanning system.

Getting Started on the IBM

Launching the Application

Launch PhotoStyler by double clicking the appropriate icon.

Pull down the File menu to reach the Scan... menu item and select Nikon Scanner Control... from the hierarchical menu. The main scanning dialog will appear as below and the Device: and Address: lines should indicate that there is a scanner connected. If the dialog appears as below, you are ready to start scanning and can proceed to Scanning a Preview Image.

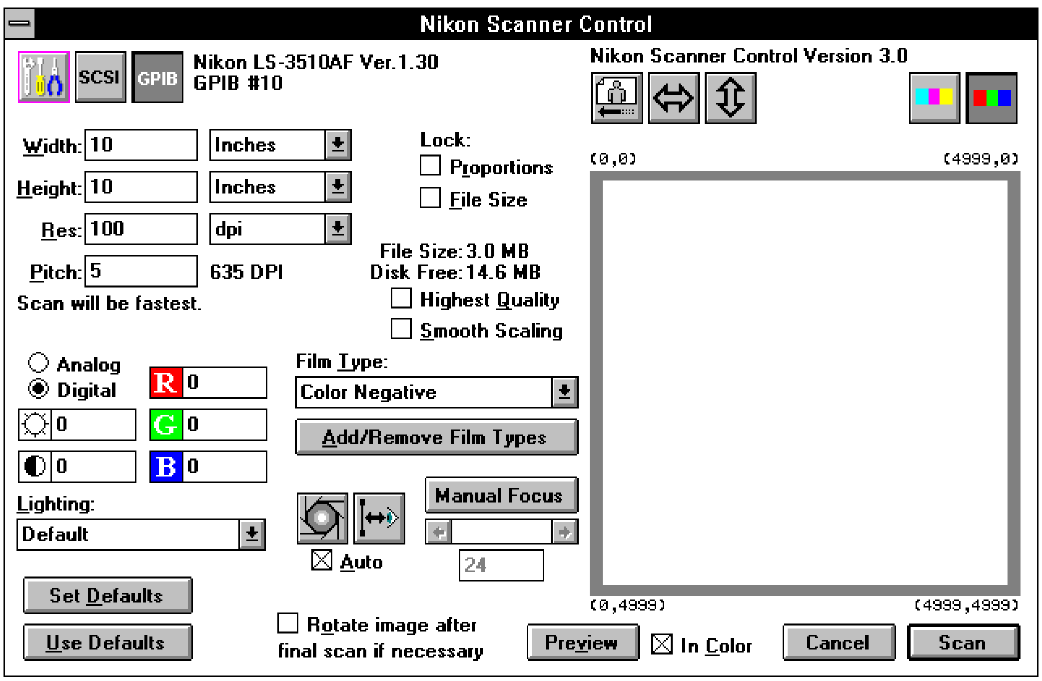

Fig. 14 Main Scanning Dialog

If the message in the upper left-hand corner reads “Nikon LS-3510AF Ver 1.xx” on either a SCSI or GPIB interface, you are ready to make a preview or scan. If not, the plugin has not found the scanner and you will need to check your SCSI or GPIB cabling, confirm tight connections and proper termination. For SCSI installations with other external devices, place the scanner at the end of the chain with the standard supplied terminator for your machine. If you are unsure what GPIB or SCSI address to use, consult the Setup Guide included with your scanner.

Scanning a Preview Image

Take out the sample slide included in the disk holder. You will be using the Standard Slide Holder for this scan. Hold the mount as in the diagram in *Fig. 15* below. Insert the slide so that the emulsion side of the film faces the front of the scanner. When viewing the slide orient the picture so the text is readable. The emulsion side is the surface furthest away from you. Since the LS-3510AF is an autofocus scanner, it will not make much difference which way you place the emulsion (other than image orientation, right-reading or backwards), although sharpest results will be achieved when the emulsion faces the front of the scanner because the imaging lens will not be reading the film through the film base, which may reduce definition, depending on the film type.

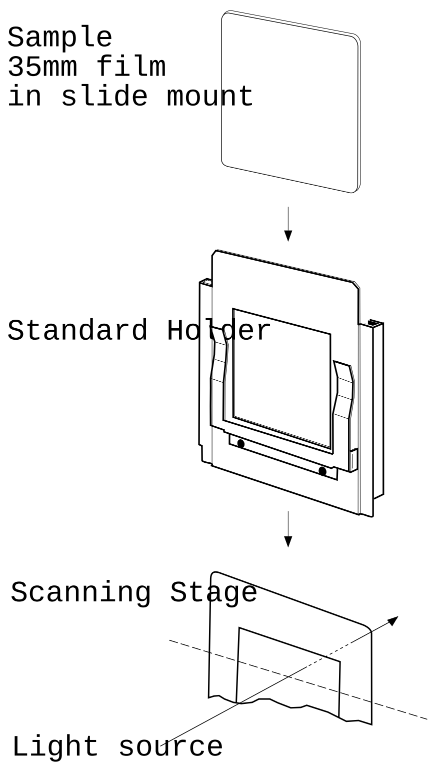

Fig. 15 Loading the Scanner

Insert the Slide Holder into the scanner so that the slide mount is closest to the lamp. Close the dustproof cover so that the outside light does not affect the scan.

The sample slide is a portrait (or a vertical image) but we will leave the default scanning orientation in the horizontal or landscape position.

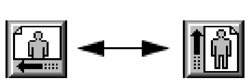

Fig. 16 Orientation

The quickest way to capture this image is to click the Preview button.

Fig. 17 Previewing an Image

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When the green *Busy* LED on the LS-3510AF goes out, you have completed the Autoexposure cycle and the scanner will automatically focus on the slide displaying the message, Performing Autofocus. After this, the *Busy* LED will immediately light up again and the scanner will begin the preview cycle as it reads the picture directly to your monitor display, field by field. We can now see the image appearing on the video screen in the scan window in the sequence red, green, then blue screens.

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Final Scan

The next step will be to perform the main scan at a higher resolution. Crop the preview image by placing the cursor at any corner of the preview, and drag to enclose the area of interest in a rectangle as in *Fig. 18* below.

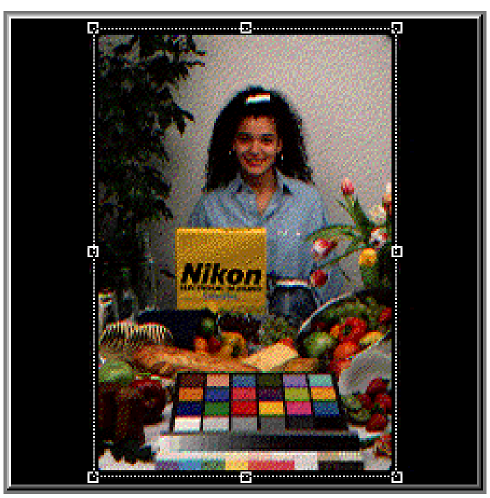

Fig. 18 Cropping the Preview Image

The resolution setting under the preview window can be left at the default setting of 100DPI. The approximate size of the output image should be 10 x 15 inches.

You are now ready to complete the final scan. Click on the scan button at the lower right of the Main dialog. The scanner will begin the scanning cycle, making three successive passes for red, green and blue. Within a moment or two, a progress indicator dialog will appear, showing the approximate duration of the scan and the portion remaining to be completed.

Fig. 19   Scanning Progress Indicator

Be sure not to open the dust cover during the scan. If it *is* opened, extraneous light could adversely affect your scan and cause density changes to appear in the image. This scan will take approximately 45 seconds to complete. A new window containing the image and labeled Untitled-1 will appear after the scan is complete. You may save the image in the normal manner or close the window and begin again.

Conclusion

You have completed Getting Started! Feel free to continue exploring on your own, but if you need quick answers to any questions, don’t hesitate to consult the User's Guide following this section. It provides complete descriptions of the plugin controls so you can exploit the full functionality of your Nikon scanning system.

Using the Macintosh Scanner Plugin

Let's begin with a full description of the main and auxiliary dialogs. All of the plugin controls follow the standard Macintosh interface design. If you are unfamiliar with the operation of the Macintosh interface, please consult your owner's manual.

The examples in this reference were used with the LS-3510AF in mind. Other Nikon scanners will vary slightly in their feature set, although all Nikon scanners can be controlled with this software.

The Main Dialog

In this section we will discuss each menu and dialog box in detail. The main dialog looks like this:

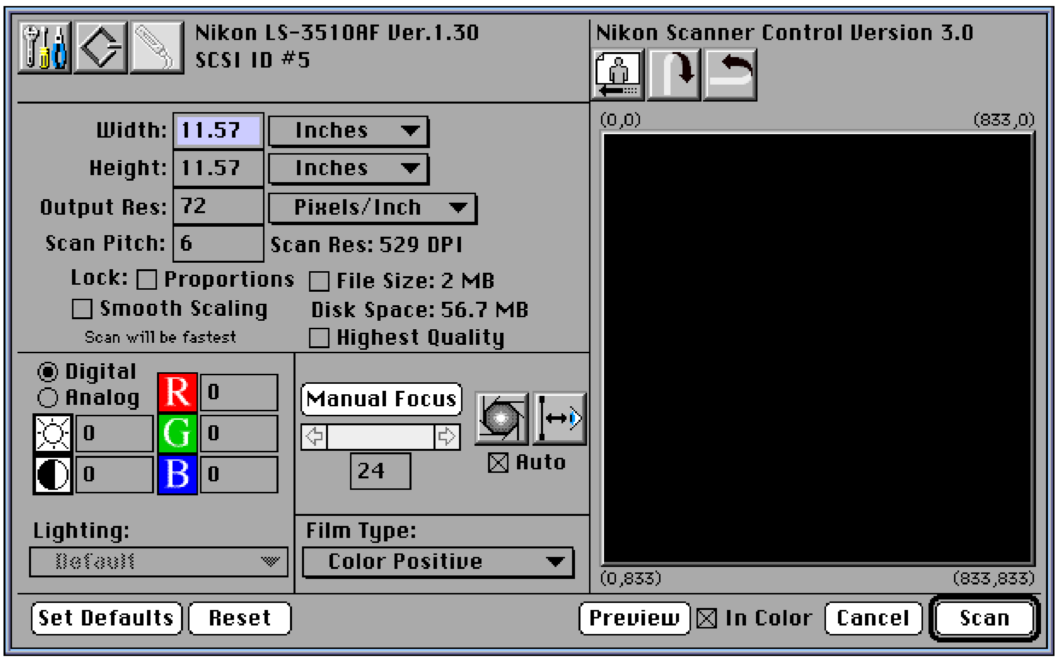

Fig. 20 The Main Scanning Dialog

Controls and Indicators

The purpose of each control and dialog item is discussed below.

Status Line

Fig. 21 Status Line

A status and information line is displayed when an action is begun. Messages include the current scanner condition and routine being performed. For example, when the Autoexposure button is pressed, the message will read Performing an autoexposure...

Film Type

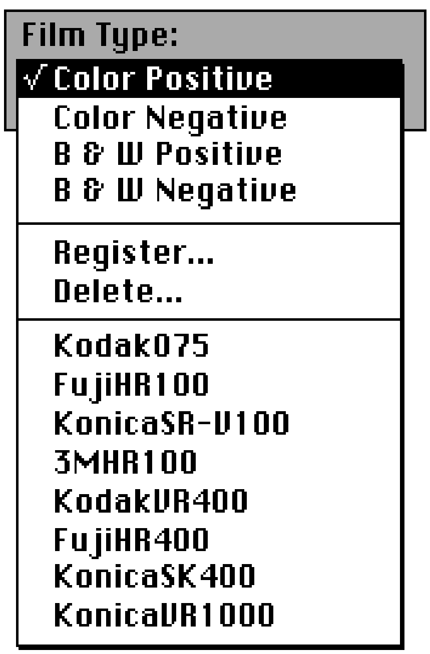

Fig. 22 Film Type

This pop-up menu allows the user to specify film type regardless of what kind of film is placed in the scanner. If a monochrome scan of a negative color image is desired, you should choose B & W Negative. The Autoexposure measurements are compensated according to tone range of the average color values. If a unique color tone separation is required, a color scan can be made and the appropriate color channel can then be manipulated in the image processing application to achieve the desired color/tone balance in black and white.

This pop-up menu also specifies color and density processing for negative or positive film types. Since color negative film is not simply the inverse of color positive film (because of the orange mask used in negative film types), accurate color and density balance can only be achieved by using analog processing of gamma and exposure. Accurate, higher quality color is maintained by using this control to modify the balancing parameters in the analog section of the scanner rather than in the image processing application where loss of bits and tone range will result.

To register and calibrate to a new color negative film type, insert a processed unexposed strip of film into the scanner, and close the cover. Choose Register from the Film Type pop-up menu and the following dialog will appear.

Fig. 23 Registering Film Type

Type the name you wish to use to indicate this film; no more than 13 characters. The register button will be enabled, and pressing it will start the calibration cycle in the scanner. This is a custom calibration specific to the film and processing that you are using. You can store up to 24 custom film types in the scanner. You can delete any of these film types by using the Delete... menu item if you need to make space for a new film type.

The calibration provides a neutral black point from the orange clear base of color negative films. Another way to calibrate is to photograph three aim points. Place a black card, preferably velvet, an 18% reflectance gray card and a matte white card in the frame. After processing, place this frame in the scanner in vertical orientation and go through the same registration procedure.

For more accurate calibration, you can use a five step grayscale for even closer correction values. Make sure that it is photographed at 5500°K. In addition, color transparency film can be calibrated the same way. When not using a grayscale, make sure that an unexposed piece of negative processed film is used. Insert the processed film so that the gray wedge is vertically oriented in the scanner.

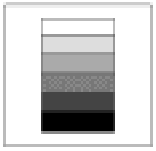

Fig. 24 Photo of Gray Step Wedge

Orientation

Portrait/Landscape

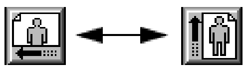

Fig. 25 Portrait/Landscape Orientation Switch

This button specifies orientation of the resulting scan from a normally mounted original. If the original is placed in the scanner in a normal orientation as viewed from the front, then the landscape button will produce the same orientation on output to the screen. Depress the button to reveal the portrait icon and the resulting scan will be rotated 90° from the position it was in the scanner film gate.

Vertical/Horizontal Flip

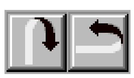

Fig. 26 Vertical/Horizontal Flip

After previewing the image you may wish to reverse from right-reading to wrong-reading (i.e. a left/right flip). This is most useful when you wish to flop the image because you have to scan it with the emulsion facing the front of the scanner when maximum sharpness is required, avoiding scanning the image through the base of the film. In the vertical orientation, you can save time if you inadvertently place the film in upside-down. These buttons stay depressed for the main scan. If there is slight speed degradation re-orienting a very high resolution scan, it may be worthwhile to re-orient the film before scanning.

Densitometer

Fig. 27 RGB/CMY Densitometer

You can measure RGB or CMY values anywhere in the preview scan by placing the cursor over the area of interest. Three numbers will appear at the top of the preview frame, initially in RGB 8-bit notation (0-255). Holding down the Command key (⌘) and clicking the mouse will change the notation to CMY values from 0-100% where 100% equals maximum density.

Sizing and Resolution

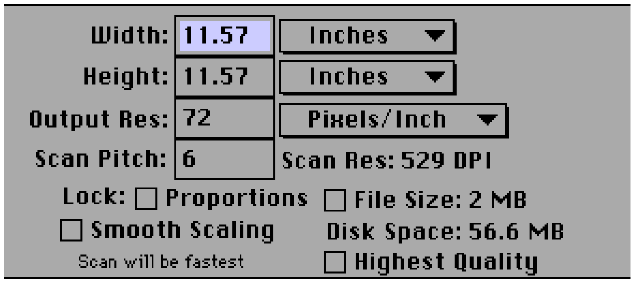

Fig. 28 Resolution and Size Controls

The scanner's total scan area is a 5000 pixel by 5000 pixel scan covering 40 x 40 millimeters. This makes for a direct-reading scan resolution of 3175 pixels per inch, or 125 pixels per millimeter. All lower resolution scans are substituted from this.

A standard 35mm frame has a scannable area of approximately 36mm by 24mm; or 4500 pixels by 3000 pixels at highest resolution. Full frame scans are typical in most applications.

The actual scan area in Figure 29 is shown as the gray square, while the film area is shown in white, superimposed over the scan area. The corner coordinates are the actual pixel coordinates of the scanner's pixel array given in (x, y) form.

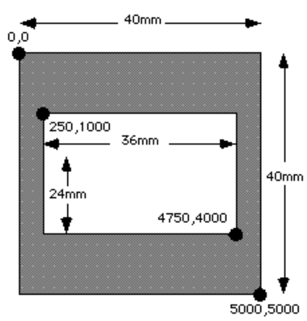

Fig. 29 Scan Area of the LS-3510AF

The scanner's "natural" orientation encourages you to place the film into the scanner with the emulsion facing the light source. You will be the best judge of whether or not this is how you wish to view the image. The tall/wide and scan orientation, and the horizontal and vertical "flips" will allow you to view the image in any way that you like. Figure 30 shows the scan specification area as it appears in the dialog. The values are the factory defaults for the LS-3510AF scanner plugin.

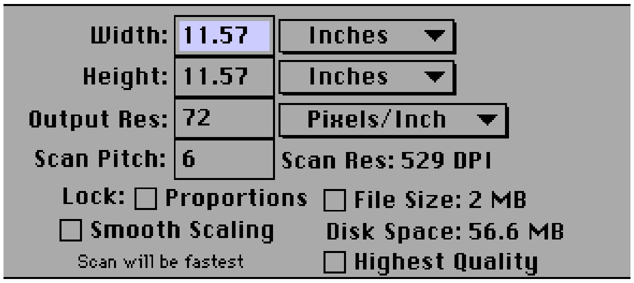

Fig. 30 Resolution and Size Controls

These text edit boxes allow you to enter sizes directly in inches, centimeters or pixels for either dimension. The numbers can be entered before or after a crop has been drawn around the subject. One method is to type in the exact numbers for the final size and resolution, and then lock the File Size and draw the crop box which will now be constrained. The resolution can also be interpreted based on CCD Pixels using a 'pitch' number. This is an integer which is used to divide the total resolution of 5000 pixels. For example, if one enters a value of five, then the resulting resolution will be 5000 divided by 5, or 1000 pixels over the full 40mm dimension of the scanning aperture, or 25 pixels/mm, 635 pixels per inch.

Scan Pitch

Scan Pitch is the number of scan area pixels that go into one pixel of the final output image. If a scan was made at pitch 2, with the crop (shown in Figure 18) of 250, 1000, 4750, 4000; the actual scan would measure 2250 pixels by 1500 pixels tall; or 1/2 the resolution of the scanner's full scan capability at 1588 pixels per inch. The image would still cover the area described above, but every other pixel would be skipped in the scan. Scan pitch is inversely proportional to the native scanner resolution.

The scanner hardware does not process fractional, or non-integer pitches. Pitches other than integer pitches are interpolated with an extra scaling step in the final scan. This can lead to some performance attrition, depending upon the pitch involved. If the plugin determines that speed may be affected, a small warning appears in the dialog just below the output scan specification area.

The range of the Scan Pitch does not go below pitch 1, or above pitch 50.

The scan is specified though a combination of selecting a crop in the preview area, and typing scan parameters into the editable text items displayed above.

There are different approaches that can be taken when defining a scan.

In the first example, to produce an 8 inch by 10 inch image suitable for 150 line screen output, set the height and width unit pop-up menus to inches, and the resolution units to pixels/inch. Then just type 8 into the width edit field, 10 into the height edit field, and 300 (for a good half-tone screen of 150) into the resolution edit field.

> Note **Although the ratio of scanned pixels to output halftone dots is traditionally 2:1, ratios as low as 1:1 can be acceptable in certain applications. We recommend 1.5:1 for most medium to high resolution four color offset reproduction.**

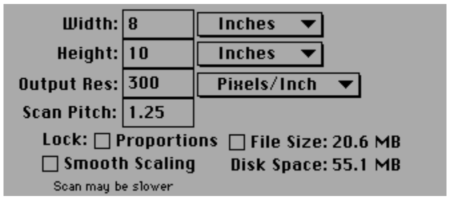

Fig. 31 Resolution and Size Controls

The crop will automatically resize itself as you do this, and you will end up with the following display:

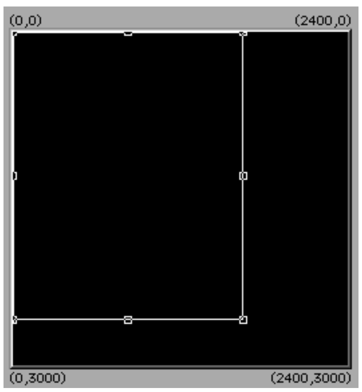

Fig. 32 Preview Window Crop

The scan pitch automatically changes to allow for the scan size requested.

You may now move the crop to cover any area of the preview that you wish to scan by placing the crosshair cursor over the crop box, holding down the mouse button and dragging the box to the new location.

If you now want to shrink or expand the crop while keeping the same *output* resolution and size, you must check the File Size: checkbox. You will now be able to resize the crop without worrying about changing your output scan parameters.

In the second example, select a crop in the preview area, and then make the crop 8 inches wide at 300 dpi. After that, make it 10 inches tall. The important thing is to get it wide enough to include the elements that you wish to see.

First, you should select the crop with the mouse:

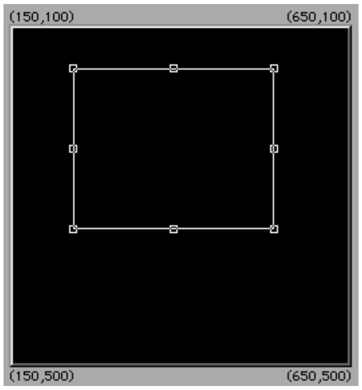

Fig. 33 Mouse Selected Crop

The resolution specification items may now look like this for the above crop:

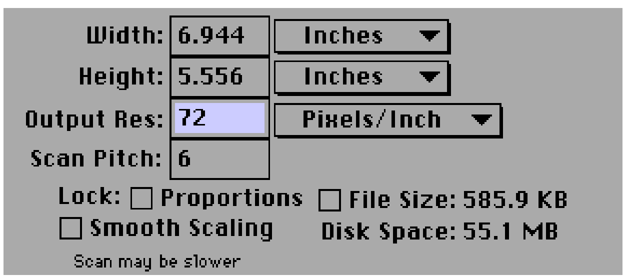

Fig. 34 Specifications for Mouse Selected Crop

Now, check the Proportions checkbox. This will allow you to enter a height or width value without changing the aspect ratio. Type 8 into the width edit field. The resolution specification items will look like this:

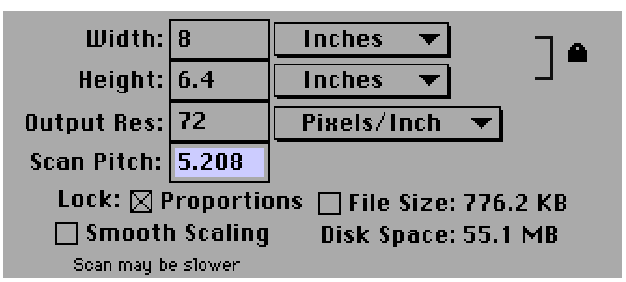

Fig. 35 Lock Proportions

Note the little lock in the previous figure. That means that any changes in width will cause a change in height to keep the scan rectangle in the same aspect ratio as before. That is what locked proportions means. The value in the height edit field changed to 6.4.

Since you don't want the width to change, unlock the proportions and type 10 into the height field. The crop's length will change, and you will have an 8" x 10" crop area in the main crop selection area. Type 300 into the resolution field, and you have the following:

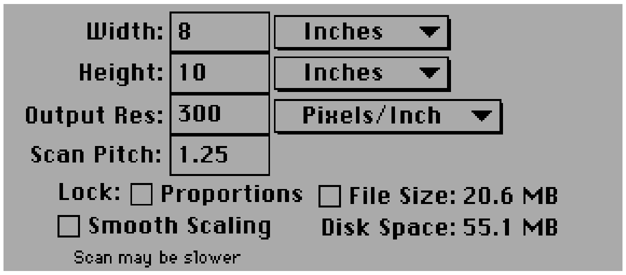

Fig. 36 Changing Resolution

The crop in the main preview area will look like this:

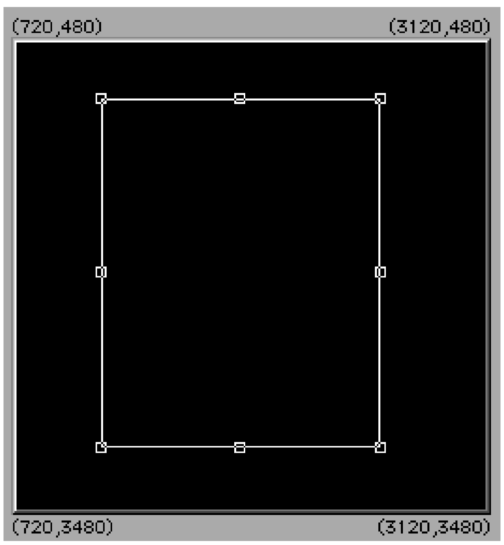

Fig. 35 Specification Crop

If you attempt to type in a number that is too large, the plugin will beep and the closest acceptable value will be substituted.

Experiment with the crop selection to see how you can best make use of it. It will allow enough flexibility to enable any scan that you may wish to make.

The Smooth Scaling checkbox sets a pixel averaging interpolator to produce smoother pixel transitions in low resolution (Pitch 5 to 50) scans.

Fig. 36 Smooth Scaling Checkbox

The Highest Quality checkbox will cause the scanner to take the scan in a special slow-speed mode to improve the registration accuracy in low resolution scans (from pitch 5 to pitch 50). In almost all cases, the difference from the normally high-quality fast scans will be negligible.

Fig. 37 Highest Quality Checkbox

Scanning Speed

There are several ways to optimize scanner performance.

You should allow Adobe Photoshop to have as much memory as possible. In order to do this, you should find the application in it's home folder, select it with the mouse, then select the Get Info menu item in the File menu. A dialog will appear with two boxes in the bottom right corner: Suggested Size, and Current Size (in System 7). The Current Size box will be editable. Type in a number greater than that in Suggested Size, and at least 2 MB less than your maximum system memory size. When Adobe Photoshop is launched after this, it will use the maximum possible memory up to the value that you typed in. If you consistently get a dialog that tells you that the application will be opened in a smaller partition, you should go back into the "Get Info" dialog, and reduce the memory requirements.

System 7 users should have 32-bit addressing *on* and virtual memory *off* in the memory control panel for best performance with greater than 8MB of RAM installed. Minimum requirements for higher performance at high resolution are 32MB installed RAM, addressable under System 7.0.

Scan in Portrait mode and place the slide in the holder in the appropriate position to get the right preview orientation. This delivers data to Adobe Photoshop in a more efficient manner than Landscape mode. You might select the crop in Landscape mode, then switch it to Portrait mode just before the scan is to be made.

In some cases, Flips may slow the scan by a small amount. Experiment to see which delivers the best results for you.

Try to use an integer pitch setting. These will always be more efficient than non-integer pitches. Experiment with selecting crops and specifying integer pitches for them.

The Highest Quality checkbox will significantly slow scans. Make sure that you absolutely need the advantages that it provides for *low resolution* scans.

Finally, different images will have varying scan times dependent upon their density. When the scanner makes an autoexposure, it decides upon some baseline parameters to optimize the image to be scanned. One of these parameters is exposure time for each color. Higher densities require longer scan times.

Grayscale/Color Preview

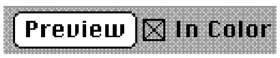

Fig. 38 Previewing in Color

Pressing the Preview button will cause a preview scan to be taken. To preview your image in color, check the In Color checkbox. Previewing in grayscale allows fast black and white previews of color scans when a quick scan and crop is required for expediency.

Interface Buttons

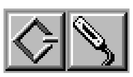

Fig. 39 Interface Button

This toggling pair specifies SCSI or GPIB interface. While opening the plugin, the software will search the GPIB and then the SCSI bus for any scanners. When found, the device found will have its ID displayed in the upper right-hand corner. If no device is found, and one is known to be connected, then the toolkit button provides a means to search the bus again for a particular address.

Digital and Analog Controls

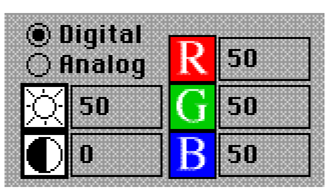

Fig. 40 Digital Control

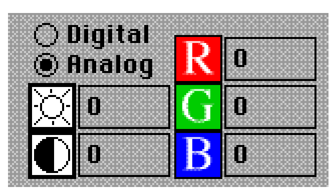

Fig. 41 Analog Control

In order to save dialog space, and to keep the user interface as uncomplicated as possible, we have assigned dual roles to the five edit items in the lower left hand corner of the Main Scanning Dialog. These items double as brightness, contrast, and tint level (digital), and as exposure time, black level, and color balance (analog). The principal difference between the two types of adjustments is that analog adjustments work on the actual CCD voltage levels and exposure times; while the digital adjustments work on the data after it has been collected from the CCD and digitized within the scanner. The advantages of using the analog controls is that they minimize data loss for large changes, such as compensating for dense images or heavy color casts. In most cases, the digital controls will afford plenty of control for the kind of minor adjustments that are usually made. The two figures above show how the two types of control sets will appear, dependent upon the state of the Digital/Analog radio button pair. Adjusting these numbers will produce a change in the preview image on screen.

Digital Mode

The digital controls all have a range from -5 to +5 with a nominal value of 0. All these controls alter the gamma in a LUT (Look Up Table) that follows the A/D (analog to digital) conversion in the scanner. The gradation changes are minor but noticeable, and will be simulated in the preview without re-scanning. Best results will be achieved with the optional 12-bit board installed when using these controls.

Analog Mode

The analog controls have a range of 0 to +255 for the brightness (exposure), and color balance controls, with a nominal value of 50, and -15 to +15 for the contrast (black level) control, with a nominal value of 0. There are five Text edit boxes controlling Exposure, Black level, and RGB color balance.

Adding to any value when scanning positives will shift the color in that direction. When scanning negatives, adding to the value removes that color. You can directly control Red, Green, and Blue gain settings from 20 to 120. The numbers that you input affect the reference value that was determined at Prescan Photometry. This reference will always be 50, so that the resulting change in exposure when these controls are manipulated is calculated as follows:

- 25=25/50 = .5 = 50% - meaning an exposure decrease of 1 stop (in photographic terminology).
- 50=50/50 = 1 = 100% - meaning no increase or decrease in exposure.
- 75=75/50 = 1.5 = 150% - meaning an exposure increase of 1/2 stop
- 100=100/50 = 2 = 200% - meaning an exposure increase of 1 stop.

You *cannot* shorten the exposure time to be less than the minimum exposure determined by prescanning. This is very often ~40. You may also find that the CCD can oversaturate on specular highlights when the exposure time is increased beyond ~100. The best application of these controls is to greatly alter the densities and color balance of a scan. For example, if an image is too green, the green *exposure* for a color positive can be decreased. Another way to counteract the overall green cast is to increase the Blue and Red exposures by equal amounts. Equal amounts of Blue and Red are equivalent to the same amount of Magenta, which is the complimentaryoor *opposite* color to Green and will neutralize it.

> Note **When increasing the *analog* exposure for a Positive scan, the resulting image or color will be lighter than before. When increasing the *analog* exposure for a Negative scan, the resulting image or color will become darker.**

The same rules apply to Exposure. Changing the exposure values here will affect Red, Green and Blue settings by an equal amount. This is a simple way to increase the brightness of a dark original transparency, without affecting the color balance of the resulting image. Again, the useful range of values typically falls between 40 and 120.

The Black Level ranges from -15 to +15. This setting determines the clamping level of the CCD for the maximum black in the image. Usually, the D_{max} (or darkest black) of an Ektachrome transparency measures 3.0 on a densitometer. The D_{min} (the lightest portion or specular highlight) often measures .8, making the overall range 2.4. This density range of dark to light is very typical, but much higher than what we usually print on paper. The Black Level Threshold control permits the user to lighten or darken the blackest black in the image. This means that as we lower the setting (when scanning positive film), the blacks will get lighter and as we raise the setting, they get darker. This happens without affecting the highlights or midtones of the image.

Auto Exposure/Auto Mode

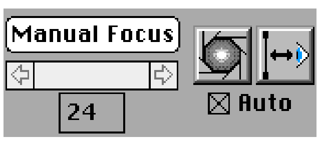

Fig. 42 Auto Exposure / Auto Mode

The autoexposure icon (the icon on the left) will cause the scanner to do what's referred to as a Prescan. That is, the scanner adjusts itself to the image by determining density and contrast. It optimizes it's internal analog levels to make the best scan possible. In most cases, the autoexposure will do such a good job that you won't need to adjust the analog or digital controls.

The Auto Mode checkbox means that the plugin will ensure that the scanner has made at least one autoexposure and autofocus before a preview or scan is attempted. This will be reset if the film type is changed, or if Photoshop is quit, then re-launched.

One of the really important features of the LS-3510AF is it's focusing and auto-focusing features. This eliminates the need for different thickness slide holders, as used by the LS-3500. In almost all cases, the standard autofocus (the icon on the right) will assure you the sharpest image possible.

In some cases, however, such as with blurry images, or warped film, you may wish to manually focus on an area of the slide. This is easily accomplished by pressing the Manual Focus button. Pressing this button puts the plugin into a manual focus mode. If you move the mouse over the preview area, you will see that it becomes a magnifying glass with crosshairs in the center. Place this cursor over the area you wish to focus on, and click the mouse button.

The scanner will take a small high-resolution grayscale scan and display it in the preview area. You may then adjust the focus by using the slider (which has now become active), or the focus stage position text edit box. The focus stage will move from 0 to 48. Most focus positions are in the area of 24 for slides mounted in plastic.

The Settings Buttons

Fig. 43 Settings

To save the complete scanner plugin configuration so that the same initial or default settings are loaded every time the plugin is opened, use the Set Defaults button. After you have made changes to the controls during a scan, if you wish to reset the plugin to the established default, use Reset.

Toolkit

Fig. 44 Toolkit Button

The toolkit button leads to a utilities dialog where you can send low–level scanner commands, calibrate and test all scanner functions. This is a diagnostic tool and care should be taken when you use it.

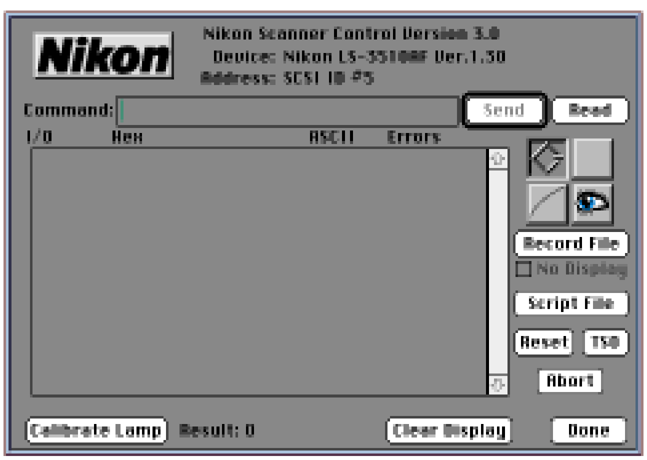

Fig. 45 Utilities Dialog

If you need assistance in understanding some of the scanner commands, consult the LS-3510AF Technical & Programmer's Reference, available from Nikon. Call your Nikon Electronic Imaging Dealer or Nikon Technical Support if you require further assistance.

The Command: text edit box allows you to enter scanner commands from the Technical & Programmer's Reference to test various combinations of scanner operating conditions that are not included in the standard operating software.

Fig. 46 Command Line

If you are developing your own software, this utility is especially helpful to determine the effect of certain scanner functions that work ‘behind the scenes’ in the plugin. Although the scanner requires commands in upper case only, this dialog converts all characters to upper case for you by reversing the operation of the shift key. The Send button issues the command to the scanner and the Read button will receive data back. Errors are reported next to the Result: text at the bottom center of the dialog box.

The SCSI and GPIB search buttons are repeated in this box as in the main dialog. They lead, however, to auxiliary dialogs as shown below.

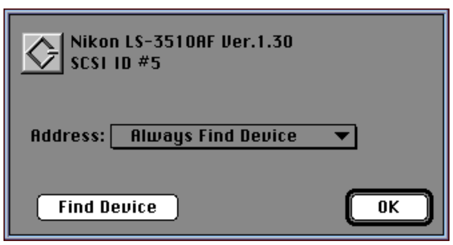

Fig. 47 SCSI Search Dialog

The SCSI button brings up the pop-up menu Always Find Device, the default setting where the SCSI bus is searched each time for an LS-3510AF scanner.

You may optionally 'hardwire' the device to the plugin by setting a specific address as shown in Figure 49.

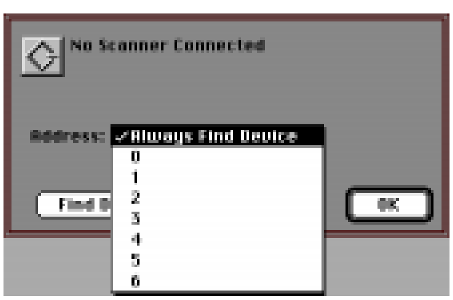

Fig. 48 SCSI Search Dialog

> Caution **Be sure not to choose IDs already in use by disk drives connected to your CPU! You may cause directory damage if the plugin attempts to write to your disk**

When you are using the GPIB, you can choose the other icon and bring up the following dialog:

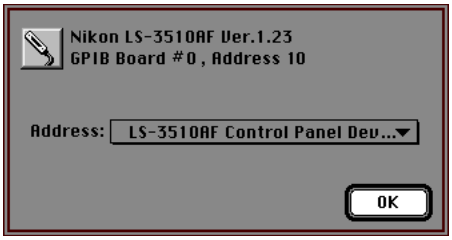

Fig. 49 GPIB Address Selection

Again, you may choose a specific address, as in the SCSI Search dialog box.

Underneath the interface icons there is a Gamma button which will display the gamma table currently in the scanner. If you press the shift key, you will get RGB. A neutral line is displayed when all three gamma curves are the same. For a better understanding of gamma, consult the section Scanning for Reproduction.

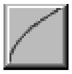

Fig. 50 Gamma Button

There is also a preview button next to the gamma icon. This will cause the scanner to scan and display the results in a preview window at low resolution. If you press the shift key, you will get an RGB preview.

Fig. 51 Utilities Preview Button

The Record File button will record all transactions sent from the command line and the data received back from the scanner. To speed up the return of long data streams from diagnostic commands like the TS5 routine (10Kbytes), leave the No Display box checked, and the Macintosh will not be required to write all the incoming data to the screen, a slow procedure. This can be a lengthy procedure if there are 5-10K worth of characters returned from the scanner in a test routine. For this reason, there is an Abort button to terminate all testing or other scanner actions. Use the Record button to write the returned data to a file that can be inspected later.

If you have long or complex tests to run you can write a macro file of commands with any ASCII text editor (such as TeachText) which can be opened using the Script button.

Just above, is a Reset button for the scanner. This issues the same INT command that is displayed in the highlighted command line of *Fig. 47*. The TSO button sends a short interface test routine which returns several bytes of data.

Clear Display removes all characters from the scrolling data window.

Calibrating the Lamp

Fig. 52 Calibrate Lamp button

> Note **The lamp should be calibrated when the scanner is first unpacked from the shipping carton.**

Thereafter, you can recalibrate whenever you change a lamp, or if you install a 12-bit board. If you move the scanner to a new location you may want to recalibrate since the bulb may change position in transit and the illumination pattern must be recompensated. This calibration is *not* intended for daily use. It writes color balance and light distribution shading information to the non-volatile memory in the scanner.

> Note **The Calibrate Lamp button should be used with caution!**

Before proceeding to calibrate the unit, you must remove any film and film holders from the unit. Otherwise it will misinterpret the light balance and attempt to calibrate to a setting that is outside normal limits. This may leave the scanner in a confused state and possibly require a call to Technical Support to remedy.

To execute calibration, close the dust cover, press the button within the Utilities dialog and wait a couple of minutes while the unit compensates and saves the data. When the busy light finally goes out you will be returned to the utilities dialog again.

> Caution **Do not disturb the scanner while this is taking place or the routines will not complete and the scanner may not calibrate correctly on the next attempt.**

You can exit after completion by pressing the Done button.

Using the Windows 3.1 Scanner Plugin

Let's begin with a full description of the main and auxiliary dialogs. All the plugin controls follow the standard Windows interface design. If you are unfamiliar with the operation of the Windows interface, please consult your owner's manual.

The examples in this reference were used with the LS-3510AF in mind. Other Nikon scanners will vary slightly in their feature set, although all Nikon scanners can be controlled with this software.

The Main Dialog

In this section we will discuss each menu and dialog box in detail. The main dialog looks like this:

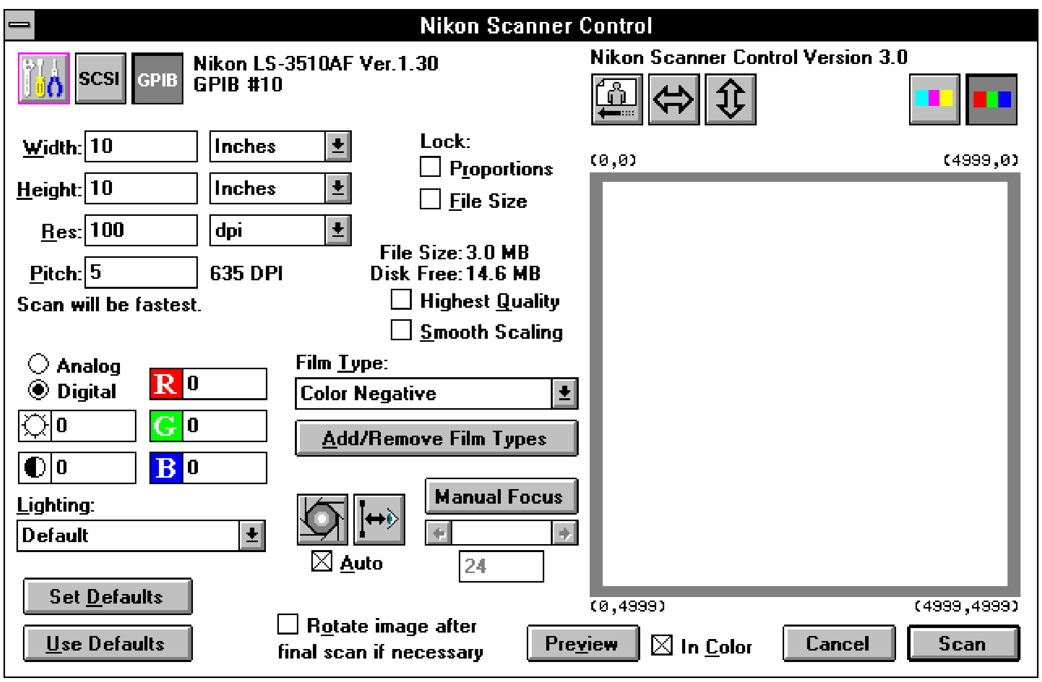

Fig. 53 The Main Scanning Dialog

Controls and Indicators

The purpose of each control and dialog item is discussed below.

Interface

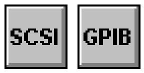

Fig. 54 The Interface Buttons

Communication with the scanner can be through GPIB or SCSI. Selecting and setting up an interface is only a matter of clicking on the appropriate button. In order for the SCSI button to be enabled, there must be a SCSI board installed that has an ASPI (Advanced SCSI Programming Interface) driver available and loaded. In order for the GPIB button to be enabled, there must be a National Instruments GPIB board with drivers for Windows (GPIB.DLL) installed. When either button is pressed, a dialog will come up.

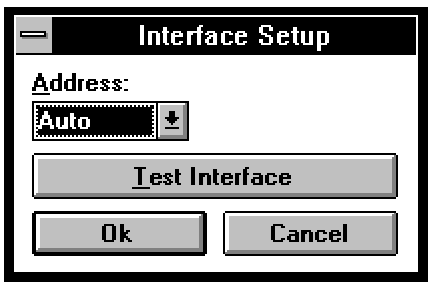

Fig. 55 The SCSI Interface Dialog

The Address control allows the choice of automatically searching the SCSI bus for the scanner or selecting a specific address. Every device on a SCSI bus must have its own address. The SCSI board itself is usually set to address 7. Hard drives are usually set to address 0. The scanner will be set to address 5 by default. The default choice is to scan the bus for the scanner.

> Caution **If the scanner is connected to a SCSI bus with a hard drive at the same address as the scanner, the scanner plugin may corrupt the hard drive.**

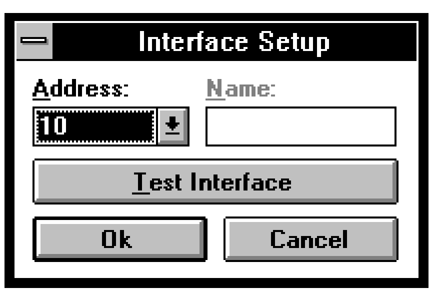

Fig. 56 The GPIB Interface Dialog

The Address control allows the choice of selecting the scanner by device name or selecting a specific address. If you are not familiar with the procedure for creating a device name, the simplest method is to choose a specific address. The

LS-3500 is set to address 15 by default and the LS-3510AF is set to address 10 by default.

For either interface, the Test Interface button will try to initiate contact with the scanner. If this is successful, the plugin will display the scanner's type and ROM version.

Scanner Tools

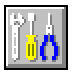

Fig. 57 The Scanner Tools Button

The Scanner Tools can be used to communicate directly with the scanner and to calibrate the lamp. If you need assistance in understanding some of the scanner commands, consult the Technical Programmer's Reference for your scanner, available from Nikon. The Scanner Tools button will be disabled if the plugin cannot establish contact with a scanner.

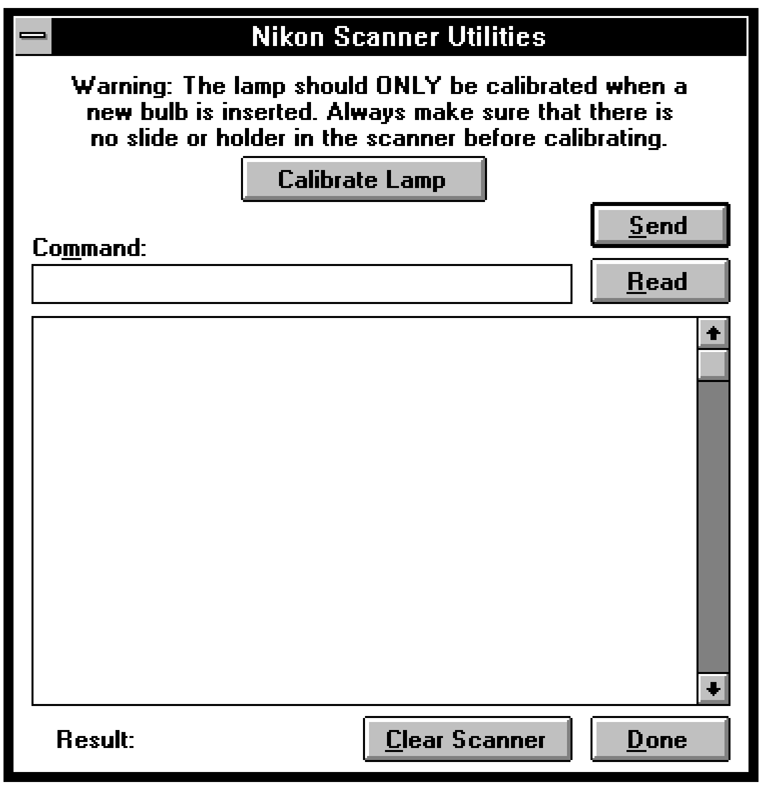

Fig. 58 The Scanner Tools Dialog

The Command text edit box allows you to enter scanner commands. Pressing enter will send the command to the scanner and make the Read button the default button so that pressing enter again will read data from the scanner. All communication with the scanner will be displayed in the scrolling edit box.

Commands sent to the scanner will be preceded by a ">" symbol and data received from the scanner will be preceded by a "<" symbol.

Calibration

The lamp should be calibrated when the scanner is first unpacked from the shipping carton. Thereafter, you can calibrate whenever you change the lamp, or if you move the scanner to a new location. The bulb may change position in transit and the distribution of light must be adjusted to.

> Note **The Calibrate Lamp button should be used sparingly.**

Calibrating the lamp will save data in the scanner's EEPROM memory. This type of memory will retain data when power is not supplied, but can only be written to about 10,000 times. Therefore, lamp calibration should NOT be a daily procedure.

Before calibrating the unit, any film or film holders must be removed from the scanner. If this is not done, the scanner will misinterpret the light balance and attempt to calibrate to a setting that is outside normal limits. Next, close the dust cover, press the Calibrate Lamp button and wait until the busy light goes out and you are returned to the Scanner Tools dialog. This process will take a few minutes on the LS-3500 and up to 30 seconds on the LS-3510AF. Do not disturb the scanner or it may not calibrate properly.

The Scanner Tools dialog is closed by pressing the Done button.

Scan Size and Resolution

The LS-3510AF total scanning area is a 5000 pixel by 5000 pixel scan covering 40 x 40 millimeters. This makes for a scan resolution of 3175 pixels per inch or 125 pixels per millimeter. All lower resolution scans are derived from this.

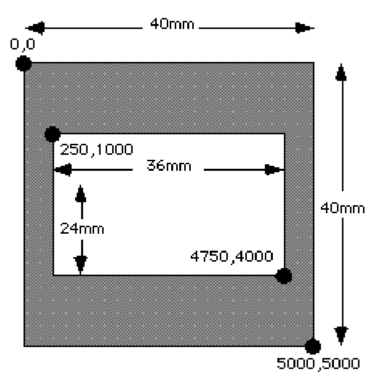

Fig. 59 Scan Area of the LS-3510AF

A standard 35mm frame has a scannable area of approximately 36mm by 24mm; or 4500 pixels by 3000 pixels at highest resolution. The full scan area is shown as a gray square with the film area shown in white. The corner coordinates are the actual pixel coordinates of the scanner's pixel array given in (x, y) form.

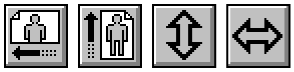

Fig. 60 The Image Orientation Controls

The tall/wide scan orientation and the horizontal and vertical "flips" will allow you to view the image in any way you like.

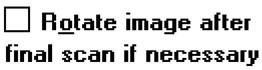

Fig. 61 Rotate Option

PhotoStyler can only accept data as rows, but both the LS-3500 and the LS-3510AF only scan columns. If you scan in wide mode, the image is fed to PhotoStyler sideways and must be rotated 90°. With this check box checked, this rotation will be done automatically. The most efficient way to scan with the LS-3510AF is to place the slide in the scanner sideways and scan in tall mode.

Scan Pitch

This number is used to divide the maximum resolution. For example, at pitch 1, the scan will be full resolution; at pitch 2, it will be half; at pitch 3 it will be one third, etc. It is the number of scan area pixels that go into one pixel of the final output image.

The scanner hardware is not capable of fractional or non-integer pitches. These in-between pitches are handled by scanning at the next higher resolution and scaling down to produce the requested scan size. You cannot scan at a pitch of less than 1.0 because this would be exceeding the maximum resolution of the scanner.

The scaling can slow the scanning process somewhat, so there is a faster scaling and a better scaling. The faster scaling may produce jaggies at lower resolutions (higher pitches) and the better scaling may considerably slow large scans without producing a noticeable difference. If the pitch is a whole number, no scaling is done and the scan data is passed directly to PhotoStyler.

Sizing and Resolution

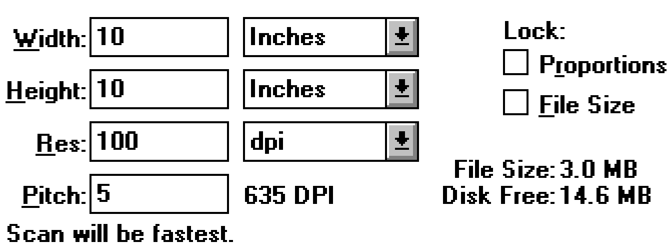

Fig. 62 Resolution and Size Controls

Although the ratio of scanned pixels to output halftone dots is traditionally 2:1, ratios as low as 1:1 can be acceptable in certain applications. We recommend 1.5:1 for most medium to high resolution four color offset reproduction. The final image size and resolution are specified through a combination of selecting a crop in the preview area and typing scan parameters into the editable text items. The plugin will constantly check what you are typing and limit it based on the maximum crop size and scan resolution.

The behavior of the controls can be changed by checking the Proportions or File Size checkboxes. If the File Size checkbox is checked, the Proportions checkbox will automatically be checked.

Width, Height or Resolution:	The crop will be adjusted. If the crop reaches maximum size, then the pitch will go down (scan resolution will go up) until it reaches the scanner's maximum scan resolution.
Pitch:	The crop will be adjusted. If the crop reaches maximum size, then the resolution will go down.
Crop:	The width and height are adjusted.

Table 1 Results of a Change With Proportions And File Size Unchecked

Width or Height:	The other size will be adjusted to keep the proportions and the pitch will be adjusted to keep the same crop. If the pitch reaches the scanner's maximum resolution, the resolution will be adjusted.
Resolution:	The pitch is adjusted to keep the same crop. If the pitch goes too low, the resolution value will be limited to the scanner's maximum resolution.
Pitch or Crop:	The resolution is adjusted.

Table 2 Results of a Change With Only Proportions Checked

Width or Height:	The resolution is adjusted.
Resolution:	The width and height are adjusted.
Pitch:	The crop is adjusted.
Crop:	The pitch is adjusted.

Table 3 Results of a Change With Both Proportions and File Size Checked

There are different approaches that can be taken when defining the final image.

By Crop Area: To scan an image that includes specific elements of the image, select a crop in the preview area and check the Proportions checkbox. This will allow you to change the width, height, resolution and pitch in any way without modifying your selection.

By Image Size: To produce a 8 x 10 inch image suitable for 150 line screen output, set the height and width units to Inches and the resolution units to DPI, type 8 for the width, 10 for the height and 300 for the resolution. The crop will automatically size itself as you do this and the scan pitch will automatically adjust to allow for the scan size requested. Check the File Size checkbox to lock in this file size. You may now move or size the crop to cover any area of the preview that you wish to scan.

To produce a specific image size (640 x 480 pixels for example) is a similar procedure, except that the width and height units are set to Pixels.

Experiment with the crop selection to see how you can best make use of it. It will allow enough flexibility to enable any scan that you may wish to make.

Scanning Speed

The most important factor in achieving the fastest scan is being able to fit the scan into memory. PhotoStyler will allocate a little extra space for an image to make the size round out to a size it can work with, so while you may have eight megabytes of memory available, PhotoStyler may start using temporary files after seven megabytes. Closing or minimizing (displaying as an icon) other images will also make memory available for the scan.

Different images will have varying scan times depending on their density. During autoexposure, the scanner will determine the exposure time for each color. Darker slides require longer scan times.

There are three factors within the dialog that adversely affect scanning speed: fractional (non-integer) pitches, checking the Highest Quality checkbox and checking the Smooth Scaling checkbox. A message under the pitch setting is continuously updated to indicate which of these is true.

When fractional pitches are used, some scaling must be done. Usually, a line of the image can be scaled while the scanner is scanning the next line. For large images, however, the scanner will have the next line available before the scaling of the previous line is complete and the scan will be slower, overall. For a full description of fractional pitches, see the section above titled Scan Pitch.

As the scanning stage moves, it will stop and start, and this may cause a slight jitter in the image. Checking the Highest Quality checkbox will ensure that the stage has settled before the line is scanned. The difference may only be discernible at higher pitches (lower resolutions) of three and up.

For fractional pitches, checking the Smooth Scaling checkbox will ensure that no data is lost during the scaling process. A complete description of scaling is in the section above titled Scan Pitch.

Color Adjustment Controls

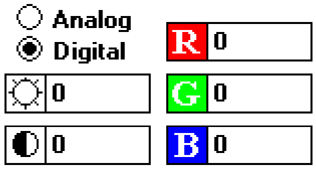

Fig. 63 Digital Controls

In Digital mode, the controls are brightness, contrast and red, green and blue tint. These controls are superseded by the tools in PhotoStyler for the LS-3500 and eight bit LS-3510AF scanners. For twelve bit LS-3510AF scanners, however, these controls offer a range of manipulation not available once the data is brought into PhotoStyler. They perform moderate alterations to the image data before that data is converted into eight bits per color.

Fig. 64 Twelve Bit Scanner Detected

A message will be displayed if a twelve bit scanner is detected.

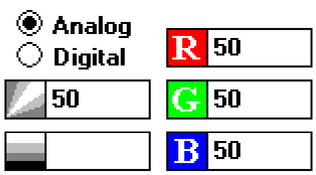

Fig. 65 Analog Controls

In Analog mode, the controls are exposure, black level and color balance. The black level will shift the voltage level that comes from the CCD array, in effect lightening or darkening the entire image slightly. This can be used to increase detail in the range of darker areas of a slide where the scanner is more susceptible to detail loss. If no value is specified, the value determined by the last autoexposure is used.

The exposure and color balance controls directly affect the time that the CCD is exposed to the film. The base value is 50, and any change is a direct ratio of the value to 50 (50/50 = 1). For instance, an exposure of 100 is twice as long as 50 (100/50 = 2) and 25 is half as long (25/50 = 0.5). In photographic terms, doubling or halving the exposure time is equivalent to one f-stop.

You *cannot* shorten the exposure time to be less than the minimum exposure determined by prescanning. This is very often ~40. You may also find that the CCD can oversaturate on specular highlights when the exposure time is increased beyond ~100. The best application of these controls is to greatly alter the densities and color balance of a scan. For example, if an image is too green, the green *exposure* for a color positive can be decreased. Another way to counteract the overall green cast is to increase the Blue and Red exposures by equal amounts. Equal amounts of Blue and Red are equivalent to the same amount of Magenta, which is the complimentary or *opposite* color to Green and will neutralize it.

> Note **When increasing the *analog* exposure for a Positive scan, the resulting image or color will be lighter than before. When increasing the *analog* exposure for a Negative scan, the resulting image or color will become darker.**

The same rules apply to Exposure. Changing the exposure values here will affect Red, Green and Blue settings by an equal amount. This is a simple way to increase the brightness of a dark original transparency, without affecting the color balance of the resulting image. Again, the useful range of values typically falls between 40 and 120.

If both the exposure and color balance are changed, the effect will be multiplied. For instance, an exposure of 25 will halve the time for all colors and a red balance of 100 will double the time for the red only.
(25/50 X 100/50 = 50/50 = 1)

> Note **Increasing exposure time will darken negatives and lighten positives and decreasing exposure time will lighten negatives and darken positives.**

The combination of the exposure and color balance controls can produce an effect that the scanner cannot produce. The scanner has a minimum exposure time which will limit the exposure value to about 20. This will vary depending on how dark the slide is, which is determined during autoexposure. On the high end, overexposing the CCD will cause overloading and a 'bucket brigade' streaking effect.

Fig. 66 The Lighting Control

The Lighting list box only appears for color negative film types. It can be used to adjust the color of the image based on what lighting conditions the original subject was photographed under. These conditions are expressed as color temperature. For instance, Early Sunset has a color temperature of 2000° K and Skylight has a temperature of 7000° K. Lower numbers are more orange in color and higher numbers are more blue. Selecting Custom... will allow you to enter a specific color temperature between 2000° K and 7000° K.

Film Types

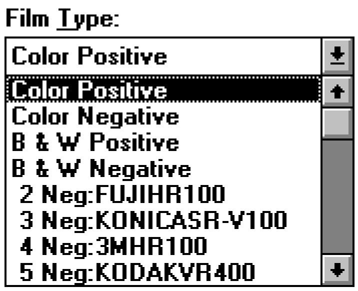

Fig. 67 The Film Types Control

The first four film types will always be present and are the standard types. These types set how the slide will be scanned. With the LS-3510AF, other color negative film types may be registered and these will appear underneath the standard types. To edit these custom types, press the Add/Remove Film Types button.

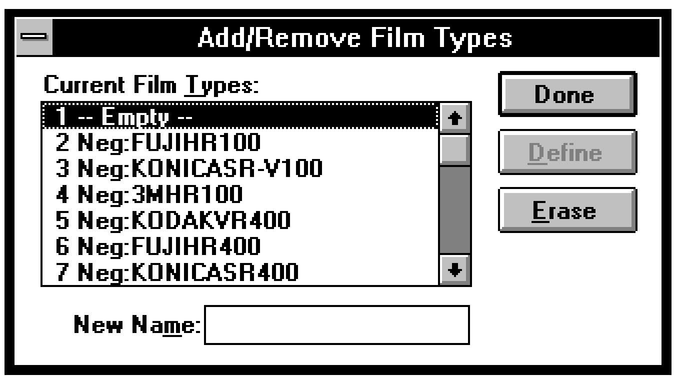

Fig. 68 The Add/Remove Film Types Dialog

To add or replace a type, first select where to put it by selecting the entry in the Current Film Types list box. Type a name up to thirteen characters long in the New Name text edit field. Place a piece of <u>unexposed</u> color negative film in the scanner and press the Define button. For best result, register the type using a gradated image from black on the bottom to white on the top.

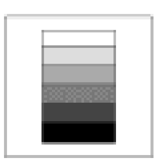

Fig. 69 Photo of Gray Step Wedge

To remove a type, simply select the type and press the Erase button.

Press the Done button to dismiss the dialog.

Autoexposure

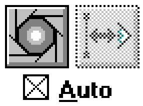

Fig. 70 The Autoexposure Button

When this button is pressed, the scanner will scan the film to determine the best exposure time. This should be done for every slide. The information is retained until the scanner is turned off or another autoexposure is done. When the Auto checkbox is checked, the plugin will automatically perform an autoexposure the first time a preview is done or before the final scan. If the Auto checkbox is unchecked and checked again, this is reset and another autoexposure will be performed before the next preview or final scan.

Autofocus

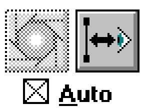

Fig. 71 The Autofocus Button

This button is only enabled when a LS-3510AF is connected. When this button is pressed, the scanner will attempt to autofocus on the film. If successful, the focus position is placed in the manual focus text edit field. The scanner may not be able to focus on a slide if it has low contrast or few sharp details. This should be done for every slide. When the Auto checkbox is checked, the plugin will automatically perform an autofocus the first time a preview is done or before the final scan. If the Auto checkbox is unchecked and checked again, this is reset and another autofocus will be performed before the next preview or final scan.

Manual Focus

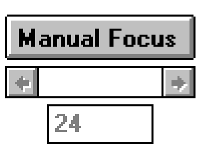

Fig. 72 The Manual Focus Controls in Normal Mode

These controls are only enabled when a LS-3510AF is connected. Press the Manual Focus button to enter manual focus mode. While in this mode, the Manual Focus button will change to an End Focus button and any crop selection will be hidden.

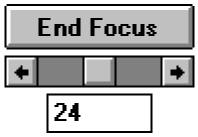

Fig. 73 The Manual Focus Controls in Manual Focus Mode

Press the left mouse button over an area of the preview to zoom in. A scan will be done at maximum resolution. Use the scroll bar or text edit field to change the focus position. Press the left mouse button over the preview to zoom out again. You can zoom in and out as you wish. Press the End Focus button to return to the normal operating mode.

Densitometer Readout

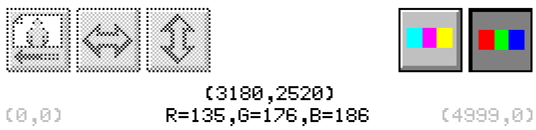

Fig. 74 The RGB Densitometer Readout

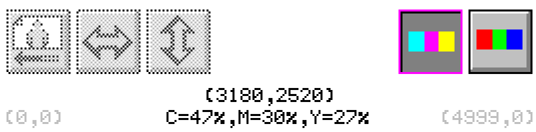

Fig. 75 The CMY Densitometer Readout

This display appears above the preview while the mouse is over the preview image. It displays the values of the preview image at the mouse position in either RGB values or CMY percentage.

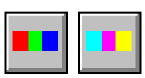

Fig. 76 The Densitometer Display Type Buttons

Press either the RGB or the CMY button to switch to that display mode for the densitometer.

Previewing

Fig. 77 The Preview Controls

When the Preview button is pressed, the plugin will do a preview scan of the slide. The film type should already be set before pressing this button. If the In Color checkbox is checked, the plugin will scan a three color preview. Otherwise it will only scan once with the green filter. For a quick preview, you can do a black & white preview of a color slide. Please note that a color preview can also be done of a black & white slide if you wish to capture a color image of a tinted black and white.

Defaults

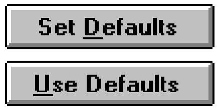

Fig. 78 The Default Buttons

The Set Defaults button will save all the current dialog settings in the PSTYLER.INI file to be used as the default for all following PhotoStyler sessions.

The Use Defaults button will revert all the dialog settings to those saved in the PSTYLER.INI file.

Status Indicator

Fig. 79 Status Indicator

This dialog appears when a lengthy process is in progress. If progress information is available, there is a display of percentage complete, otherwise, a striped bar is drawn. If there is no way to cancel the operation, the cancel button is disabled.

Fig. 80 Status Indicator With No Progress or Cancel

Messages include the current scanner condition and routine being performed. For example, when the Autoexposure button is pressed, the message will read Performing an Autoexposure. The time bar allows you to see how far along the routine is.

Scanning for Reproduction

Two areas of great concern in image input and output are density and color balance. What follows is a description of the problems the imaging system may have to deal with and how we manipulate the controls to achieve the best corrections.

Gamma

There are eight bits available in the scanner output LUT for assigning tonal values or shades. (in the 12-bit version of the LS-3510AF, there are 12 in and 8 out of the 12x8 LUT, or 12 raw bits out). In our binary system, twelve bits results in 2^{12}, or 4096 shades and eight bits results in 2^8 or 256 separate and distinct shades that can be read and encoded. This means that if we begin to reduce the number of bits used, (when we significantly alter the endpoints or highlights and shadows of our table) then we have fewer displayable shades with which to imitate the tonal range of the original. For example, if we reduced the range from 0-255 to 0-128 (or 2^7), then we effectively would only have 128 shades with which to represent every shade from the original image. This can lead to tone wedging, sometimes called “posterization” or “tone breaks” that make continuously shaded surfaces look “banded” where certain in-between shades are missing.

If we need to make extreme changes to image densities or color balance, the Analog Controls internal to the scanner allow a greater degree of manipulation without relying on a set number of bits for continuous shading, as the image processing application might do. Since, in a non-digital electrical circuit, there are no discrete steps imposed by the number of bits to encode and decode a certain shade, there will be no gaps between points, no aliasing or stair-stepping, on an analog gamma curve. All non-digital electrical circuits can vary their power output, whether they are controlled by current or voltage devices (transistors or tubes), in a smooth and continuous way, and are limited only by the precision of the electrical components in the system. This precision limitation is what causes us to use the scanner or computer’s *digital* LUT’s for more accurate, if not continuous manipulations.

The essential concept here is that you must make use of both types of controls in any digital input system. The Nikon scanner’s auto modes make use of this, and you can control it manually as well.

Color Balancing

As an example of color balancing using digital LUT precision, when a photo shows a green color cast in the shadows and a magenta color cast in the highlights we have a common occurrence in traditional imaging called a 'cross-curve'. The color cast cannot be corrected using Analog RGB controls, since globally adding magenta or subtracting green to correct the overly green shadows, would make the highlights even more magenta, and adding green or subtracting magenta to clean up the highlights, would make the shadows overly green. The two extremes must be corrected separately, so we use the gamma curve controls of our image processing application to neutralize (or add magenta to) the greenish shadows and remove or subtract the magenta in the highlights. If the highlights are already too bright, we can add green to them (making them darker and neutralizing the magenta at the same time). If the midtones are being affected, then we can use the gamma controls to adjust the middle balances.

This midtone control is essential for balancing skin tones with greater accuracy while preserving the balance in the light and dark areas of the photo. In any case, usually some combination of these techniques can be applied to improve bad color casts and “muddy” images. You will need practice to determine the range of control movement for a particular effect. In general, small changes in the gamma curves are very noticeable, and a subtle approach will yield more pleasing results. The beginning technique, however, involves making more extreme changes and then choosing some point between these extremes.

This applies to using all the Analog Controls. For example, when adjusting the Blue balance to correct an overly “cold” or bluish image, move the control all the way from 50 to 35 and see what happens. If the resulting image is too “warm” or reddish-yellow, then you can estimate the proper correction much more quickly than if you had only corrected to 48 and still found the image too “cold”. It is always better to go beyond the anticipated correction first, and roll it back later to fine tune the results.

Color Reproduction Background Information

The color dyes that are used in photographic film and papers are formed when color couplers, compounds that are essentially colorless in their unprocessed state, are developed out with tanning developers to form a color dye with certain spectral characteristics.

To begin with, color films contain the same light-sensitive silver halide grains which are found in black and white emulsions. The couplers are con-contained in separate silver halide layers with a colored filter layer between each. These filters will pass only certain bands of the spectrum to the emulsion layer below. The red sensitive layer receives red light, the green layer, green light etc. After exposure and development, there exists a fully formed negative metallic silver image representing the image in each layer, R, G, and B.

For a slide film, the latent (unprocessed) silver image is first developed to form a metallic silver where the silver halide (usually bromide or chloride) has been exposed to light, then the silver image is chemically reversed from negative to positive, and then the couplers that are attached to each silver crystal are further developed to form a color dye corresponding to the metallic silver grain at that location. The dyes that result are cyan at the red silver grains, magenta at the green silver grains, and yellow at the blue silver grains. After this is completed, the silver is bleached away and the dyes remain to form the color image.

For all E-6 or similar process slide films such as Agfachrome, Ektachrome, Fujichrome, etc., (the “chrome” stands for color coupler names such as mydochrome and tolochrome) the couplers are incorporated in the manufactured film.

The K-14 Kodachrome process is rather special in that it starts out as a monochrome film with no color couplers and they are added when the film is processed. This process is a very difficult to control, but it has remained a favorite among 35mm photographers for some time. Color negative (C-41 process) films also employ couplers and are engineered to be more accurate in color reproduction by using special “mask” couplers to make up for the deficiencies in the cyan, magenta, and yellow dye transmission characteristics. The reason for these deficiencies is similar to what is discussed in the ink-based printing process in the Undercolor Removal procedure.

All dyes and pigments are to some extent deficient in their color spectral transmission. This means that they do not transmit the ideal bands of light that we are interested in. For example, magenta dye formed from couplers transmits a little too much yellow (or rather absorbs too much blue), making it appear too red.

In transparency films, there is not much we can do to alleviate the problem except to improve the dye balance and structure. In negative films, since we anticipate going to a CMY based photo printing paper that is exposed with tungsten light, we can add masks to the dye layers to compensate for the deficiency in the original image color characteristics. The same technique applies to the cyan layer. In general, color negative films tend to scan with better results than transparencies, because they have a flatter gamma (lower contrast) and the Dmax is relatively low. Also, the mask colors help to improve color reproduction, the grain size has been diminished for the relative film speed, and the emulsions are considerably sharper than they used to be. For the photographer, these films have much more latitude, that is they tolerate much greater over and under exposure while retaining detail (flat gamma helps).

Offset printers have shunned these films in the past because they are much harder to separate on traditional drum scanners. Sharpness usually suffered when a printer had to scan a positive print or transparency made from a second generation dupe of the negative original. Since the reading routines on the Nikon scanner have been tailored to match both positive and negative emulsions, this is no longer a constraint.

When images are printed with ink, we must use the same subtractive primaries to form the image as in the photographic printing process. These process colors consist of Yellow, Magenta, Cyan, and blacK inks formed from finely ground pigments much the same way watercolor dyes are made, except that the pigments for dyes are much more finely ground and are usually in aqueous, or water-based mixtures. Printers inks are mostly oil-based and use carbon-based solvents.

In the offset lithography process, the master plate consists of a two-dimensional or non-relief image. The printing dots are formed by exposing a gelatin coated plate to ultraviolet light. The areas that are so exposed are developed with a tanning agent so the gelatin becomes hard and attracts water. The unexposed areas wash off and the remaining metal surface does not attract water. The plate is wrapped around a printing cylinder and it dips into a water bath. The dark areas of the plate (metal) do not attract water, but the light, gelatin coated areas become water-saturated. Next, the plate comes into contact with an ink cylinder covered with the particular process color for that image layer — cyan for the red sep, magenta for the green etc. The ink only sticks to the parts of the plate that are not wet, since the oil-based ink repels water. The image is then transferred from the plate to a "blanket" intermediate cylinder, and then to the paper. Hence the name Offset . Lithography comes from the Greek word 'lithos' for stone. In the early days, lithography was performed with stone plates. This process is essentially different from all other printing processes which rely on a relief, or three dimensional image on the plate to carry ink to the paper.

In newspaper printing the letterpress method is still common. It uses a printing plate exposed to light and then etched so that the dots are raised up and away from the plate surface. The dots are variably sized, as in offset printing, to allow shading by dithering so that continuous tones are simulated with greater and smaller dot percentages on white paper space. These raised letterpress dots are inked from an inking cylinder and they then transfer their ink dots to paper. The resolution in this system is relatively low (up to 100 DPI reliably) and it does not allow for anything lighter than a 5% dot (not paper white) since these areas have to support the paper from collapsing against the plate.

Another popular method is called rotogravure and is familiar to most Sunday Times Magazine readers. In this process the cylinder is engraved so that the exposed areas form small 'wells' for each dot. The wells vary in depth and so they hold a different quantity of ink for each dot depending on how much they were exposed and engraved or etched. The preparation for such a plate is very expensive and there is no 100% reliable method of proofing(other than on press) as in the offset Matchprint® or Chromalin® methods. For this reason, the process is used solely for extremely long runs (over 1,000,000) where the plate is much more wear resistant than offset plates. One of the nicest attributes of gravure is the heavy, saturated look to the image. Using gravure plates, you can put more ink on paper in a single pass at high speed, than you can with offset. This leads to essentially the highest visual dynamic range (for luminance and saturation) achievable on high-brightness paper. Another important attribute is that the process is very insensitive to paper stock surface. This means that you can print on very poor quality paper and achieve very good results as compared to offsets' need for very high quality stock surface for good results.

Perhaps the only disadvantage to gravure is that line art must be reproduced with the same cell structure, so that type may only be printed at a maximum resolution of 175 DPI (compared to the line art generated at 2,000-3,000 DPI on laser image setters) so small type sizes are difficult to print legibly. Gravure can be printed in a continuous tone method because of the variable depth "wells", but offset can only be printed as a halftone, unless a very slow and expensive process called collotype is used. Collotype is the ink printers equivalent to the photographers "dye transfer" process,oor the Techni-color® motion picture process. Again, tanning is employed on a gelatin based matrix to produce a 3D-relief image. This matrix holds the dye or pigment which is subsequently transferred to the paper or film. This method yields the highest possible resolution and image quality, however the runs are limited to roughly 5,000 copies, as compared to 500,000 for offset plates and 2-3 million for gravure plates.

There are many other forms of printing from Flexography (using rubber plates) for packaging, to wood and stone cut artists plates. In photography, there is an even greater variety of printing methods, from black & white carbro and platinum prints to the very expensive dye transfer process, and more recently to the thermal dye sublimation process used in the Nikon CP-3000 Full Color digital printer. This new technique has much in common with the continuous-tone gravure process in that it uses variable-density ink transfer from constant sized dots or “cells” rather than variable dot sizes as in halftone reproduction.

Most DTP scanner users are concerned with the lithographic process only, (although letterpress can also use the negatives produced this way). The most important aspects for calibrating this process are dot and screen control by angle, frequency and size (gain). To make good color separations from your scans, you should have access to a complete output system from image setter, through film proofing ColorKeys® or Chromalins®, to progressive and press proofs. You should also be using a densitometer to measure both the film originals before scanning and the resulting printed pieces. Access to proper separation guides and step wedges for calibration is essential. If you begin by using a service bureau for these necessities, then try to stick to the same one.

Above all, use a scientific and calculated approach to calibration. Haphazard “we’ll-run-it-when-we-like-the-way-it-looks” methods that don’t rely on writing your data down and consistent measurement techniques, can only lead to costly revisions every time you start a job. Since the intention is to save time and money, you must be as professional in your methods as any printing craftsman would.

There is a considerable amount of theory that must be understood before printing practice can become second nature. For example, let’s look at how Gray Component Replacement, or GCR works. Understanding the technique will help you to achieve better results from a variety of source images.

If there is an area of a print where you find equal amounts of cyan, magenta and yellow inks, you can replace a certain percentage of these with black ink. Of course, this assumes that equal quantities of cyan, magenta and yellow inks mix to produce a neutral black. In fact, they do not. This mixing usually results in a muddy brownish hue or desaturated color rather than a clean neutral gray.

The replacement of colored ink with black ink is a very difficult technique to master. At one extreme, if you replace all the heavy common densities (shadow areas) of YMC with heavy densities of K without replacing some component of the mid-tones densities with neutral, then the result is an unnatural surface and color effect on the printed piece. In fact, there should always be at least 10-20% YMC color remaining in all tones from highlight to shadow when printing a normal color piece. This applies to the 10-20% of highlight dot, in that the neutral areas should be printed with some component of colored dots. It is immediately apparent, especially in the midtones, when the dot pattern reverts to a simple, overly neutral halftone of medium-percentage black dots., a rainbow effect will appear where the colored dot midtones break above the gray replacement point.

Also, in dark areas, where a large percentage of common color YMC inks have been replaced with black, the depth of the ink (the richness) goes flat because there is low ink surface volume on the page. When the same density is produced using YMC or YMCK then there is a greater quantity of ink laid down and the richness or depth is immediately apparent. Flemish painters like Rembrandt realized this and used the oil medium to build up a shadow area to maximum black using many layers of colors on top of each other. If they had simply used a black pigment, there would have been no depthoor penetration of the shadows, no content. In the above example, the lack of depth in the deep shadows of our printed image would contrast greatly with the more robust layers of color which formed the neutral lower-midtones even though they are lighter densities. Also, this GCR technique, when badly handled, generally leads to a severe tone break that is not necessarily due to a lack of bits in the digital representation, but due rather to the jump from four color to one color, being set at a level where their is a natural break forming in the image shading content, such as strongly defined dark shadows which merge with the lighter side of a contrasty subject. Portraits that are low-key and contrasty are the worst candidates for this type of color correction. It is best to avoid or reduce the use of GCR when printing difficult subjects like faces (especially on short runs where the cost of ink is not a major component of the job), since the tone breaks will always appear adjacent to continuous midtones in a face that requires a delicate gradation balance.

Finally, for gray replacement in the *midtones*, it is generally true that using several screens of small dot size fills in the pattern of holes between variable high contrast dots better than a single large size dot pattern. The surface effect that you may detect from bad GCR is simply the lack of more diverse layers of ink, where a single screen of medium black dots does not have the same surface sheen as several screens laid down at different angles with smaller colored dots. The latter is easier on the eyes, and in the lower midtones, the dot pattern is harder to detect. In any multiplexed representation system, it is always better to increase the frequency of the sampling, i.e.. lots of smaller dots are better than fewer larger dots. When viewed from a certain distance they both appear to be the same shade. Of course, there is a natural limit to this in that the finest *controllable* printing dot in an ink litho system is difficult to produce at finer than a 1/200th of an inch screen size.

At that size, the accuracy of the dot size is harder to control because the capillary action of the paper has already caused it to bleed sideways to perhaps twice its original size. Normally the dot gain as it is commonly called, is limited to 2-5% on film and perhaps as high as 10-15% with ink and paper. This dot gain produces a muddy, desaturated and low definition result. The effect cannot be seen on a film dot proof such as a 3M Match Print® or Dupont Chromalin®. These proofs use a light sensitive color pigmented emulsion to reproduce the dots from the original separation films. Because the dots are photographically “hard”, they don’t bleed by capillary action, their gain is limited to the photographic gain caused by the irradiation of exposure and processing.

If the terminology is beginning to sound confusing, this is because it *is* confusing and it is now time to turn to the Glossary for some relief.

Glossary of Computer Imaging Terms

A/D Conversion	analog to digital signal conversion.
absolute address	the x and y pixel coordinates in a pixel map using global coordinates in a locally cropped area of a larger image .
analog gamma function	a non-linear function used in analog signal processing.
aspect ratio	the ratio of width to height in an image. The Nikon scanner permits the selection of different pitch resolutions for X and Y axes, and thus alter the aspect ratio, or ‘stretch’ the image in a vertical or horizontal direction.
analog signals	these electrical signals represent or are “analogous” to real world events such as a sound or pattern of light. An “analog” is a simile or representation of something else.
ASCII	a coding system used to represent characters using binary storage.
auto gamma	an automated mode in the scanner firmware to provide the best gradation tables for the reproduction of an image.
band sequential	color pixels stored in separate planes in the same file, or as separate files. Sometimes called planar, screen, or field sequential.

Baud rate	see bps.
binary	a number system which uses a base of two. Used for the majority of computing systems, since electrical logic circuits are easily constructed with a small positive (+) voltage to signify On, or True, and a lower voltage used to represent Off or False.
binary output	the Nikon scanner can generate what are known as binary, or bi-level, bit-mapped or high-contrast black and white images with simply two tones, black or white, and a pixel being either on or off.
bit	A binary digit representing 0 or 1, true or false.
binary images	these are high contrast, bit-mapped images, used to represent line art and typography.
byte sequential	color stored in triplet pixels for RGB, HSV, etc., or quadruplet pixels for RGBÅ, YMCK, etc.
bps	bits-per-second — this is used to measure transmission rates of digital information and can be used instead of Baud rate when *more* than one bit is effectively sent for every cycle of the transmission signal.
buffer capacity	the available space to store information in any system. “Buffer” usually refers to intermediate storage for processes that would otherwise 'bottleneck' a system.
bus	a parallel connecting scheme for multiple devices.

calibrate	to measure the results of the imaging process on a known color/gray scale target and real life subjects. This quantitative measurement is called sensitometry, where we measure the values of the input and output. We can then define a function for the changes that are introduced by the imaging system. This transfer function can then be used to “calibrate” the imaging system.
CCD	charge-coupled device. This is a solid state memory unit with storage cells that can accumulate electron charges.
CCD gain	the voltage gain in the scanner's CCD circuit .
clamping level	the voltage limit of the CCD output can be clamped at a particular point, allowing the black level of the image to be established, so that regardless of the exposure increase, the black level stays the same.
CPU	central processing unit.
cropping	trimming an image.
color balancing	the process of balancing the color of an image. Scanner plugins allow the user to control color balance in an R,G,B color model.
color models	there are many ways to describe color. Color spaces are three dimensional, that is they consist of units of measurement along three different axis. We generally talk about three common characteristics.

1) Luminance (brightness, lightness, darkness, or value): the pixel's shade from dark to light.

2) Hue : the color’s name and relative position in the visible spectrum.

3) Saturation (purity, degree of gray contamination): the color’s strength or intensity resulting from the quantity of neutral that is mixed with the color.

Some common color spaces are: RGB, YMC, YMCK, HSV, HSL, HSI, YUV, YIR, YIQ, YCC, CIE L*a*b, CIE L*U*V* etc. Colors can also be specified using Munsell, Hunter, Pantone®, ANPA or other color matching systems.

contrast — the difference between the lightest and darkest shades in a picture. The slope of the function of exposure versus density is, in effect, the contrast, also called gamma.

decimal — a number system of Arabic origin, which uses a base of ten. It also includes various types such as integers, rational, real and imaginary numbers, etc.

daisy chain — a series of devices connected together with a beginning and end-point, unlike an endless loop.

digitized — the process of converting a continuously variable signal into a quantized representation, usually coded in binary.

DIP switch — dual in-line pin switch.

dither	to make use of different tonal values or shades together in a pattern to smooth the transition between two different tonal areas. To create the appearance of more gradations by blending small components of different densities alternately together.
dither pattern	a two-dimensional matrix used in the dithering process. This commonly measures from 2x2 up to 8x8 cells, with different values in each cell. As the dither matrix grows, more shades can be simulated, but the image will appear less and less defined (sharp) as small details of high contrast pixels are spread over a wider area.
driver	an intermediate software or firmware controller for various input/output devices connected to a computer, and the application running on it.
EEPROM or E2PROM	Electrically Erasable Programmable Read Only Memory.
effective reading area	the useful reading area on the Nikon scanner.
emulsion	The light sensitive coating in photographic film or paper. The side of the film bearing the emulsion or image layer is usually slightly matte (non-reflective) when viewed with an oblique light source, compared to the base or non-emulsion side. Can also be determined from the readability of the manufacturers identification markings. When these ID’s are readable (film direction arrows will always point to the right), the emulsion side is facing away from you.

four-color process	the use of four subtractive pigment-based primaries, Yellow, Magenta Cyan, and blacK, to reproduce the full spectrum in print. Can also be achieved with three color process, Yellow, Magenta, and Cyan, which are theoretically the compliment (opposite) to the three additive primaries, Blue, Green, and Red.
exposure shift	a change in a lighter or darker direction.
GCR	gray component replacement is the use of black ink to substitute for common quantities of colored inks. In other words, when the print has a large gray area that is being reproduced using approximately equal quantities of cyan, magenta, and yellow ink, the common component of the three colors can be replaced with a similar density of black ink. Also called ‘achromatic’ reproduction.
gray balance	the relative proportion of primary colors, additive or subtractive, needed to produce a neutral tone from dark to light intensities.
GPIB	General Purpose Interface Bus, sometimes called HP-IB for Hewlett Packard Interface Bus, and standardized as the IEEE-488 bus.
HEX or (h)	a number system which uses a base of 16. Where we use the first ten numbers in the Arabic system and continue on with letters: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.
hue	a discrete, fully saturated color, is given a name. This name is its “hue”. The same hue is referred to

	by different descriptors depending on the color model being used.
handshaking	the process of acknowledging transmission and reception of data through hardware or software.
interleaved	refers to a color pixel storage structure where the RGB elements of the pixel are all present in consecutive order at one memory location for that pixel. Non-interleaved or planar means that the red, green and blue pixels are stored in different planes or files. See band sequential, byte sequential, line sequential, full chunky, chunky planar, and full planar.
intensity	see color models.
irradiation	photons entering a light sensitive film emulsion tend to 'bounce around' resulting in diffusion of sharp lines and loss of definition. This can be minimized with thinner emulsions and a light absorbing base under the sensitized layers.
high-key	describes an image where most if not all of the subject matter has a density range from midtones to highlights. A predominantly light picture.
HP-IB	see GPIB.
line-sequential	where color is stored in RGB, YMCK, etc. lines of pixels instead of bytes or planes. Sometimes called row sequential for a horizontal raster.
luminance	see color models.

low-key	describes an image where most if not all of the subject matter has a density range from midtones to shadows. A predominantly dark picture.
LUT	look-up-table — used to transpose one value into another via some predetermined scheme.
LSB	least significant bit — the right-most bit in a binary code.
palette mapping	assigning colors to particular areas of an image based on shade or some other description. Often used to produce visually continuous tone color images when there are very few colors available in the palette to do so.
moiré	an undesirable visible interference pattern created when dot screens overlap at certain frequencies. This pattern can be subdued or eliminated through trial and error and compromise. The angles and frequencies of the four process screens must be manipulated to reduce the effect.
MSB	most significant bit — the left-most bit in a binary code.
NB-Handler control panel	The National Instruments GPIB interface control panel device.
ND filter	neutral density filter — used to lower density (make darker) without affecting color balance.
non-volatile memory	memory that retains the bit settings after power is removed from the system.

parallel interface	an interface where bits are transmitted side by side on multiple conductors. Transmission speed is much greater than that of serial interfaces but transmission line lengths are extremely limited without considerable amplification. Compare to parallel interface.
photoelectric conversion	the process of converting photons (particles of light energy) into an electrical signal representation.
photometry	the process of reading densities through photoelectric conversion. Also related to sensitometry or densitometry which can be performed using visual matching as well.
pixel	the smallest discrete element in a picture, usually square in a digital system. Short for picture element. These elements can also be irregular shapes and randomly spaced like silver halide grains in a photographic emulsion. Also called pel.
PostScript®	a page description language authored by Adobe Systems. It is used extensively in the desktop publishing industry to translate digitally stored images, raster and object types, to a raster-oriented printing device, such as a laser printer or laser typesetter.
proofs	when it is necessary to approve the image quality before a quantity press run, proofs are made. In order of expense, the cheapest are Transfer Key® or 3M Color Key® types. These are four colored (YMCK) layers of acetate that have been exposed to the BW film separations and then processed. They

	are taped in register in a sandwich so they can be viewed together or separately. More common are Matchprints®, Chromalins®, etc., where the four layers are reproduced in register on one sheet which is then laminated. The above proofs are all photographic in nature and produce a hard dot structure unlike ink, which bleeds. The final proof type is a press proof, which requires expensive setup and prep time. It does, however, simulate the press run very accurately.
progressives	a four color ink proof made on press, where each plate is printed separately and in various combinations with the other three so that the four color images can be properly evaluated for dot gain and the overall quality of the color separations. Also called “progs”.
prescan	photometry performed by the scanner before a screen preview.
pseudo-color images	when colors are assigned to monochrome shades to give meaning to areas in the picture. Often used in satellite imagery to define vegetation and geological information. Can also refer to simple tinting of monochrome images, like oil-coloring BW prints.
RAM	Random Access Memory.
raster	a lattice of parallel lines used to represent an image by varying the brightness of points on each line. The raster is a regular pattern of thin, horizontal, equally spaced bars.

refractive index — the factor by which a material, such as glass or water, causes light wave/particles to change velocity. This change in velocity is a change in direction rather than speed since the speed of light is constant. The result is that light waves change direction when they pass through a boundary from one material, such as air, to another, such as glass or water. This change can be viewed directly, as when a magnifying lens bends light, or when water magnifies the part of an object which is submerged. The change in angle can be calculated from this “index of refraction”. Certain materials having a higher density, will bend light more than others. Different types of glass can possess larger or smaller indices of refraction.

registration — the accurate placement or line-up of discrete image elements, in superimposition such as in multiple pass scanning or four-color printing plate registration. This term is also used to refer to the downloading of commands to the LS-3510AF memory.

resolution — the fine-line definition or resolving power of an imaging system. A measure of optical performance. Also refers to the number of dots or pixels used to define an image. The more dots per unit of measure, the higher the resolution, but not necessarily the definition.

reversal films — film emulsions that have been designed to be exposed and developed as a negative, and then reversed by chemical or light-induced fogging, to produce a positive image from the unprocessed portions of the negative. The negative image is then

	bleached away, leaving a positive silver layer for black and white, or three silver layers with color couplers for a color image. For color, the silver is bleached away, leaving the color couplers which are then developed out to become color dyes.
RGB gain	the Red, Green and Blue exposure settings on a Nikon scanner.
RGB sequential separation	the process of separating the red, green and blue layers into three fields.
RS-232C	a serial interface used on most computers.
screen	a lattice of lines used to create mechanical halftones in the photographic process. These halftones are mostly generated digitally these days.
serial interface	an interface where bits are transmitted one after the other. Serial interfaces require only two conductors and can have very long transmission line lengths. Compare to parallel interface.
shading compensation	the CCD element normalization process in a Nikon scanner which compensates for different CCD element sensitivities to light in a linear array.
slice level	the threshold which is used to set a pixel either white or black, when converting from continuous tone or grayscale shaded originals.
slide mount	a paper or plastic frame used to hold film for projection or viewing purposes.

stage	the moving platform used to mount the slide mount holder for the Nikon scanner.
subsampling	the process of reducing the number of discrete pixels in an image by throwing certain ones away or averaging several together to form a single one.
tone wedge jump	posterization caused by having too few bits to represent the number of tones needed in an image.
vector conversion	the conversion of information from scalar to vector. Vector information is defined as having magnitude and direction. In other words, a point in space can be defined in a Cartesian coordinate system, and there is a vector specifying that location in space. In imaging, we can convert a pixel from a value at a particular x, y location, to a vector number which defines its magnitude as well as its spatial location in one number. This system is used extensively to mathematically represent randomly shaped objects so that computers can “draw” them. Mostly for bitmapped images like typefaces and logos, where the values do not vary beyond bi-level (high contrast black and white).