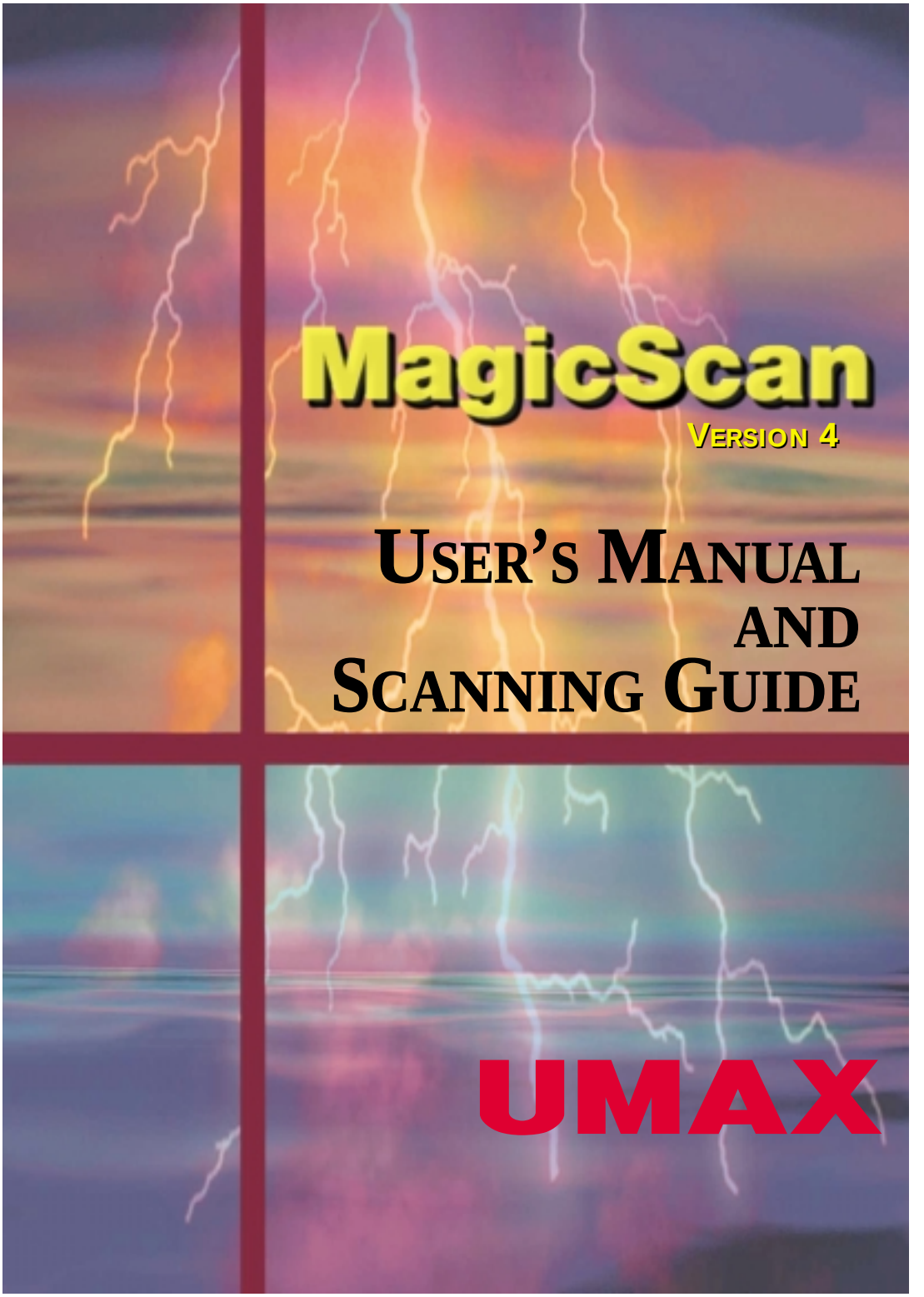
MagicScan
VERSION 4
USER'S MANUAL
AND
SCANNING GUIDE
UMAX

MAGICSCAN
VERSION 4

USER'S MANUAL AND SCANNING GUIDE

UMAX TECHNOLOGIES AND TAZ TALLY

1999

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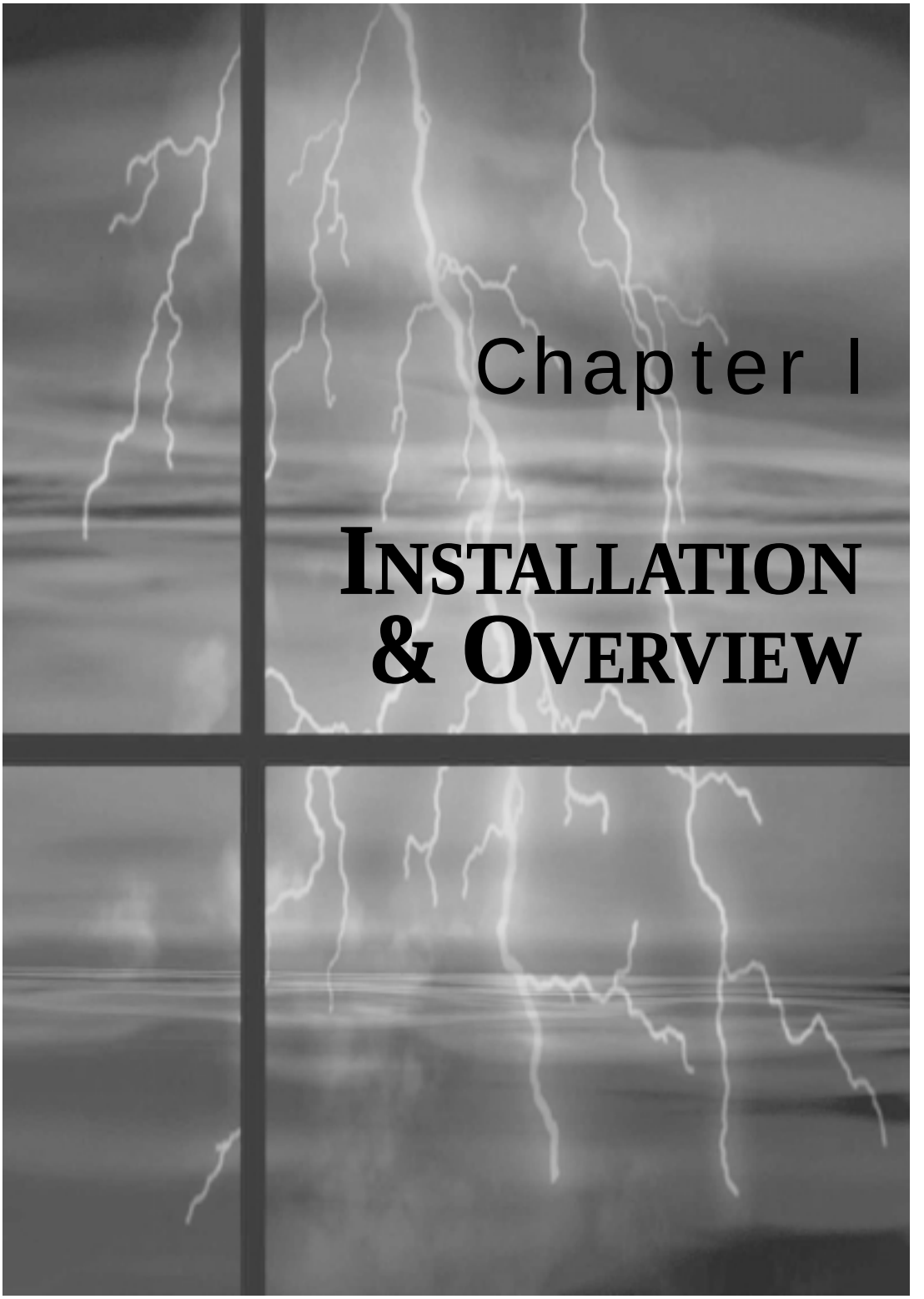
Table of Contents



Chapter I

INSTALLATION & OVERVIEW

CONVENTIONS USED IN THIS MANUAL

Menu choices

The following type of sequence in parentheses indicates a sequence of menu choices in an application (Main Menu, ‘Sub menu ‘Sub, sub menu). For instance, this Photoshop sequence (Image menu ‘Adjust ‘Threshold) indicates that first the Image menu is selected, then the Adjust Sub menu choice under the Image menu, then the Threshold Sub, sub menu choice under the Adjust sub menu.

Key words and concepts

The following bold and italics formatting of text will indicate a key word or concept which bears special attention: ***Edge Reproduction***. These key words or concepts will often be found in the glossary as well as in the body of the manual.

MagicScan system requirements

CPU Recommended

Macintosh: Power Macintosh

Windows: IBM PC compatible with Intel 486, Pentium (or higher) compatible CPU, Pentium with MMX preferred

Memory recommended

64MB or more preferred

Video display recommended

Macintosh: Color monitor with 24-bit (millions of colors) video display card

Windows: VGA minimum, 800 x 600, Super VGA preferred (High color 16-bit or higher)

CD-ROM drive

Required for installation

Free hard drive space

170MB required, 300MB preferred

Operating system

Macintosh: System 8.0 or later

Windows: Windows 95, 98 and NT 4.0 or later

Interface

Macintosh: Plug-in or Twain

Windows: Twain

Scanner requirements

PowerLook II, PowerLook III, PowerLook 3000, Mirage II, Mirage IIse

INSTALLING MAGICSCAN

You may have received software other than MagicScan with your scanner. Please install your image editing software first, then MagicScan, then any other software (i.e. binuscan PhotoPerfect).

Figure 1 MagicScan CD Icon
Double click on the CD icon to access its contents.

Mac MagicScan installation

1) First, quit any open applications and disable any automatic virus protection which may be active prior to installing any software.
2) Insert UMAX MagicScan CD into your CD drive. Note: The same CD is used for both Windows and Macintosh computers.
3) Once the icon for the MagicScan CD appears on your desktop, double click on the MagicScan CD icon, shown in Fig. 1, to access the contents of the CD. You may want to view the contents by selecting an icon view in order to make the contents easy to see.

Figure 2 Scanner Registration
Double click on this icon and follow the instructions in the sequential windows to register your UMAX scanner.

4) You will now see two(2) icons, one for UMAX Scanner Registration and one for the MagicScan Installer. It is a good idea to register your scanner first, so that you do not forget to do so.
5) Double click on the UMAX Scanner Registration icon, Fig. 2, to start the registration process for your scanner. Follow the instructions and fill out the requested information in each of the sequential windows presented by this registration utility.
6) After your scanner registration procedure is complete, double click on the MagicScan Installer icon, Fig. 3, to initiate the scanner software installation procedure.
7) Follow the instructions in several sequential windows to choose a language version, view a ReadMe document, and accept the software use agreement. We recommend that you closely read the ReadMe file, as it contains important information about the installation process and any late-breaking information which did not make it into the manual. We also recommend that you print out this ReadMe file and clip it to the inside cover of your manual for easy reference.
8) When the MagicScan Installer dialog box appears you will have two basic choices, an Easy Install and a Custom Install Option.
9) Easy Install will install the Universal Plug-In, Universal TWAIN, MagicScan DA, MagicMatch, ColorSync and Apple Compatible Driver.
10) Custom Install allows you to choose what is installed, or change the directory.

Figure 3 MagicScan Installer
Double click on this icon to begin the scanner software installation.

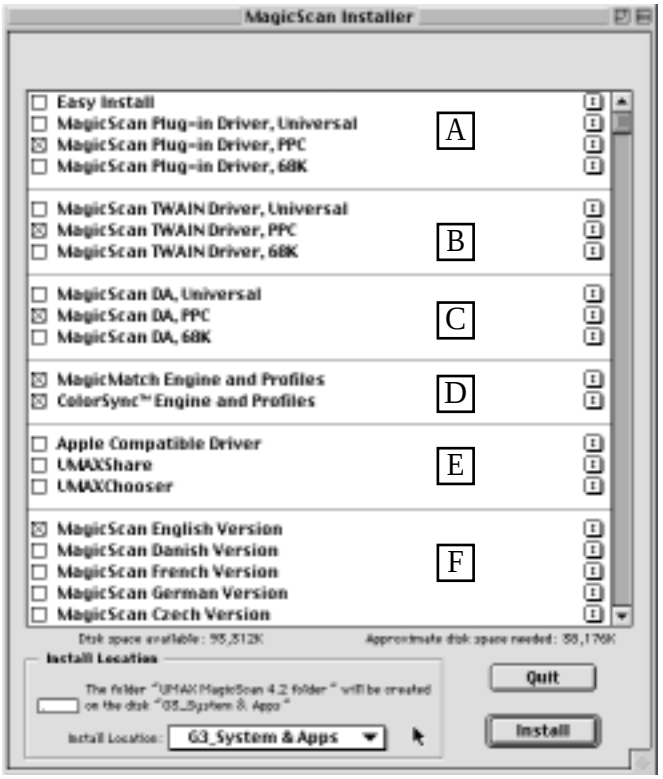


Figure 4 MagicScan Installer

Choose to perform a custom install option in this Installer dialog box. Custom Install allows you to control the installation process and select only the software and capabilities you wish to install. Also be sure to select the proper drive on which you want your scanning software installed, by configuring the "Install Location" in the lower left hand corner.

11) Before you begin deciding what you want to install, verify where you would like to have the MagicScan components installed by selecting a disk on which to install the software. Refer to the lower left hand corner of the Installer window (Fig. 4). It is usually best to use your boot drive which, on a Mac, is the drive in the upper right hand corner of your desktop.

12) To control your own installation, first click on the expand window box in the upper right hand corner of the MagicScan Installer window. This will give you a better view of your installation options.

13) You will notice that there are six separate sections in the installer window, with each section separated by a thin gray line. Check out each section and choose any items you would like to have installed. Following is a brief description of each Installer section:

Section A selects the Plug-in Driver Type. Select the driver type which best describes your computer. Universal refers to the Plug-in which will work on any Macintosh, PPC refers to the Plug-in for Power PC Macs, while the 68K choice will load a Plug-in version which will work on Pre-PPC (68030 and 68040 CPUs) Macs. It is not a requirement to load this Plug-in, and you may not need to if you use a Plug-in and/or TWAIN described in Section B below.

Section B selects the TWAIN Type. Shown here is a TWAIN for a PowerPC computer. It may be best to select both the Plug-in and the TWAIN, as some software applications do not support Plug-ins.

Section C selects the Stand Alone Scan Driver Type, or Direct Access (DA). If you decide to use a stand-alone scanner driver rather than a plug-in or TWAIN driver, select the driver type which best describes your computer. No stand-alone driver is selected for installation here. A stand-alone driver allows you to scan to a file without having Photoshop® open, which saves memory. You may

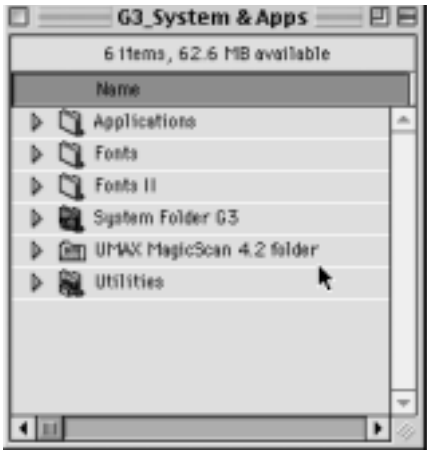


Figure 5 MagicScan Folder
A portion of your MagicScan software will be installed in a folder on the drive you selected in the Installer window. Open this folder and follow the final instructions contained in the enclosed ReadMe files.

also choose to set up a dedicated scanning station for higher productivity.

Section D selects the Color Matching/Management tools. Select the Color Matching of management tools appropriate for your Mac or Windows computer. These tools are usually used in one of the two automatic scanning modes. Shown here are MagicMatch and ColorSync tools and profiles. Note: The use of these color matching/management tools generally requires the use of additional system software components such as a basic ColorSync engine.

Section E selects Additional Driver Selections. UMAXShare is for sharing a scanner across a network. UMAX Chooser and Apple-Compatible Driver are for utilizing your scanner with OCR (Optical Character Recognition) software. No additional drivers are selected here.

Section F selects a Language. The language you selected in the language choice screen will appear here. MagicScan automatically defaults to your computer's native language. English is selected here.

14) After making all of your choices, click the "Install" button in the lower right hand corner of the "Install" window. Your chosen software will be installed on the drive you have selected. If you chose not to register your software earlier, you will receive another chance to do so at the end of the installation procedure. Please register your software.

15) Some of your software will be installed in a folder on your targeted drive (Fig. 5). Open this folder and follow the instructions contained in the enclosed ReadMe file. The final steps to finish up the installation of your scanner software may involve dragging your Plug-ins and/or color management input/export filters into their respective plug-in and input/export folders. These folders are located inside the folder of the application, such as Photoshop®, through which you choose to scan.

16) The final step after finishing your installation is to restart your computer. This will allow your computer's operating system to recognize and make available your new scanning drivers and color management software.

MACINTOSH QUICK-START

Your first scan

Now, that you have hooked up your scanner and installed your software we know that you are anxious to perform your first scan and capture your first image with your new scanner. To learn to really control your scanner and get the best results you will want to complete this training manual, but here is a quick-start procedure to help you capture your first scanned image:

1) Be sure that your scanner is plugged into a power outlet, turned on, attached to your computer, and unlocked.

2) Open the scanner lid.

3) Place the sample grayscale portrait photo (see pocket in back of the manual) face down on the scanner, and squarely along the edge nearest the front of the scanner. (Be sure not to cover the separate glass calibration strip nearest the front of the scanner.) Close the lid.

4) Launch the stand-alone MagicScan scanning software driver, or acquire the MagicScan software driver plug-in or Twain through the File–Acquire menu in Photoshop®.

5) In the scanner control window choose “Manual” near the top of the window.

Moving down the Scanner Control window:

6) From the first pull-down menu select “Flatbed(Reflective).”

7) From the second pull-down menu select “Gray 256 scales.”

8) From the third pull-down menu select “200dpi.”

9) In the Preview Image window click the “Preview” button near the top. Wait for the scanner to complete its preview scan.

10) Click on the Selection Frame tool, found at the top of the Preview Image window tool set.

11) Now select the entire grayscale portrait image by clicking and dragging across the image from the upper left-hand corner to the lower right-hand corner of the photograph. Be careful to select only the image and not its white border.

12) Click the “Auto” button located along the lower left-hand side of the Scanner Control window.

13) Now click the “Scan” button near the upper right-hand corner of the Preview image window.

14) Wait for the scanner to complete the scan.

15) Your first scanned image will appear on screen at the completion of the scanning process, if you have acquired your image using a plug-in or Twain through Photoshop®. If you have used the stand-alone MagicScan module, you may view your image by opening it in an image-editing application such as Photoshop.

We strongly recommend that you take the time to thoroughly review the remainder of this manual to gain a full understanding of scanning concepts and procedures. The remainder of this first chapter, Installation and Overview, will provide you with a thorough overview of the MagicScan scanning software controls. Chapter II, Scanning Fundamentals, provides you with much interesting, important, and useful background information on scanning terminology, concepts and challenges. Chapter III, Scanning Techniques, provides you with detailed step-by-step procedures on calibrating your scanner for the best and most consistent scanning results, as well as for scanning a wide variety of images including simple, intermediate, and complex line art, gray scale photographs, color photographs, negative and positive images, printed images, scanning multiple images and information on customizing your images for specific uses such as for print or for use in Web pages.

Figure 6 MagicScan CD Icon
Double click on the CD icon to access its contents.

Figure 7 MagicScan Setup
Double click on this icon to begin the scanner software installation. In this example, F is the CD ROM drive.

Windows Installation

1) First, quit any open applications and disable any automatic virus protection which may be active prior to installing any software (i.e. binuscan PhotoPerfect).

2) Insert UMAX MagicScan CD into your CD drive. Note: The same CD is used for both Windows and Macintosh computers.

Figure 8 Windows Language Select Screen
Select the language you would like to be used and then click "Next>".

Figure 9 Windows Welcome Screen
When this dialog box appears, click "Next.>"

3a) After you insert the MagicScan CD, the installation will automatically launch from the CD if AutoRun is active on your computer.

3b) If AutoRun is not active, double click the My Computer icon. Double click on the MagicScan CD icon (Fig. 6) to access its contents. You may want to view the contents by selecting an icon view under the "View" menu in order to make the contents easy to see. You will now see numerous icons, including one for the MagicScan "Setup" (Fig. 7). Double click on the "Setup" icon to start the software installation.

4) The "Select Language to Install" dialog box appears (Fig. 8). Select the language you would like to be used in your MagicScan menus, palettes and dialog boxes. Then click "Next>" to continue the installation process.

5) The next dialog box to appear is the "Welcome to the UMAX Setup Program." Click "Next>" to continue the installation process.

6) The next screen to appear will be a license acceptance screen, informing you about the license restrictions associated with the use of the software. Read this information and click "Yes" to accept the license agreement.

7) When the MagicScan Installer dialog box appears you will have two basic choices, a "Typical Installation (recommended)", and a Custom Installation (Fig. 10).

"Typical Installation" will automatically install MagicScan, MagicMatch, the User's Manual on your C Drive in a folder called "UMAX". Unless you have some specific reason for wanting to alter

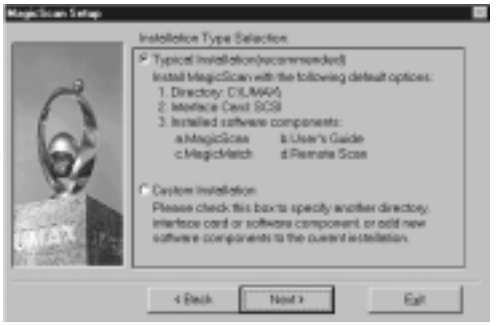


Figure 10 Windows Installation Choice
Select "Typical Installation" and then click "Next".

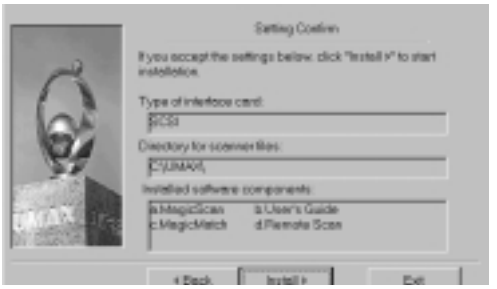


Figure 11 Windows Setting Confirm
When this dialog box appears, confirm the Interface card, Directory location and software to be installed. Click "<Back" to redefine these choices. Click "Install" to continue the installation process.

Figure 12 Windows Searching for Scanner
The last step of the windows installation involves the search for the scanner. Once this search is completed you will be able to launch your UMAX MagicScan software and it will automatically connect to and acquire your UMAX scanner. You will then be ready to scan.

this automatic setup, we recommend that you choose this installation option. Custom Install allows you to choose what software is installed and/or change the directory in which it is installed. Click on the small button next to the "Typical Installation" choice. Then click "Next>" to continue the installation process.

Note: If you perform a "Custom Installation" in which you do not install all of the software and/or you decide later to install more software, or change the location of the MagicScan software, you can run "Custom Installation" to accomplish this.

12) After you click "Next>" in the Installation Type Selection, the next window to appear will be the "Setting Confirm" screen (Fig.11). This screen contains a list of the selected interface card, directory location, and the list of software to be installed. Check to confirm that all these are correct. If they are not correct, click "<Back" to return to the previous screen to correct your choices. To initiate the actual installation of your UMAX software click "Install>".

The installation of your UMAX scanning software will be performed. Once your software installation is complete, the last step in this installation process involves your "Setup"software searching for your scanner to complete the connection between your UMAX scanner and your UMAX software. While searching for your scanner to complete the connection, the "Searching UMAX Scanner" screen (Fig. 12) will be visible. Allow this Searching process to complete. Once the entire installation process is complete, restart your Windows operating system software. Your MagicScan software will now be available in your Windows "Start" menu, under "Programs".

13) After you finish installing MagicScan, UMAX requests that you register. The registration process will start automatically.

14) To view the online manual, click "Next>."

WINDOWS QUICK-START

Your first scan

Now that you have hooked up your scanner and installed your software, we know that you are anxious to perform your first scan and capture your first image with your new scanner. To learn to really control your scanner and get the best results you will want to complete this training manual. Here is a quick start procedure to help you capture your first scanned image:

1) Be sure that your scanner is plugged in to a power outlet, turned on, attached to your computer, and unlocked.

2) Open the scanner lid.

3) Place the sample grayscale portrait photo (see pocket in back of the manual) face down on the scanner, and squarely along the edge nearest the front of the scanner. (Be sure to not cover the separate glass calibration strip nearest the front of the scanner.) Close the lid.

4) Launch the stand-alone MagicScan scanning software driver, or acquire the MagicScan software Twain through the File–Acquire menu in Photoshop®.

5) In the scanner control window choose Manual near the top of the window.

Moving down the Scanner Control window:

6) From the first pull-down menu select “Flatbed(Reflective).”

7) From the second pull-down menu select “Gray 256 scales.”

8) From the third pull-down menu select “200dpi.”

9) In the Preview Image window click the “Preview” button near the top. Wait for the scanner to complete its preview scan.

10) Click on the Selection Frame tool, found at the top of the Preview Image window tool set.

11) Now select the entire grayscale portrait image by clicking and dragging across the image from the upper left-hand corner to the lower right-hand corner of the photograph. Be careful to select only the image and not its white border.

12) Click the “Auto” button located along the lower left-hand side of the Scanner Control window.

13) Now click the “Scan” button near the upper right-hand corner of the Preview image window.

14) Wait for the scanner to completes its scan.

15) Your first scanned image will appear on the screen at the completion of the scanning process, if you have acquired your image using a plug-in or Twain through Photoshop®. If you have used the stand-alone MagicScan module, you may view your image by opening it in an image-editing application such as Photoshop.

The best quality images

We strongly recommend that you take the time to thoroughly review the remainder of this manual to gain a full understanding of scanning concepts and procedures. The remainder of this first chapter, Installation and Overview, will provide you with a thorough overview of the MagicScan scanning software controls. Chapter II, Scanning Fundamentals, provides you with much interesting, important, and useful background information on scanning terminology, concepts and challenges. Chapter III, Scanning Techniques, provides you with detailed step-by-step procedures on calibrating your scanner for the best and most consistent scanning results, as well as for scanning a wide variety of images including simple, intermediate and complex line art, gray scale photographs, color photographs, negative and positive images, printed images, scanning multiple images, and information on customizing your images for specific uses, such as for print or for use in web pages.

MAGICSCAN OVERVIEW

Figure 13 Acquire Menu

One of the most important aspects of your scanning system is the software which drives and controls your scanner. This software allows you to take advantage of the scanner's features and capabilities. In this section we will review the features of the MagicScan scanning software.

Plug-in and TWAIN

It is important first to point out that while many people scan *through* Photoshop® or another image-editing software, it is not the image-editing software, but the scanner software, MagicScan, which controls the scanner. MagicScan can be loaded, launched, and used as a stand-alone piece of software, or used as a plug-in (Mac) or TWAIN (Mac and Windows) to your image-editing software. The advantage of using MagicScan as a plug-in or TWAIN module through Photoshop® or other image-editing applications, is that once you complete the scanning process with MagicScan, your image will automatically be opened in your image-editing application for viewing or editing. In either case the MagicScan software has the same capabilities. Plug-in and/or TWAIN access to the scanner through Photoshop® is usually made through the File – Import menu and sub menu in Photoshop® (see Fig. 13).

MagicScan Menus

Macintosh Menus

Windows Menus

MagicScan has six (6) Macintosh and five (5) Windows menus which are used to access MagicScan's capabilities. We will review each menu here briefly. The Mac and Windows menu items differ slightly. We will use all Mac menus in Part Two of this manual: Image Capture and Editing.

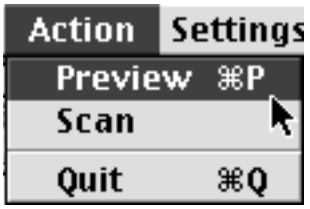


Figure 14 Mac Action Menu

Action menu/File menu (Mac only)

The action menu (Fig. 14) can be used to initiate both preview and final scans, and can also be used to quit the MagicScan application.

Settings menu

The settings menu (Fig. 15) is used to set up the basic parameters and get information about your UMAX scanner. The top portion of the menu is used for determining the scan setting to be used for saving, loading, or resetting scan settings on a Mac. The SCSI ID choice allows you to get scanner network ID info, and a remote scanner control (required on the Mac only) which allows you to use a remote scanner across a network. Remote scanner access is automatic in Windows. The Preview and Unit section allows you to determine the portion of the scan bed which will be scanned during preview scans and the units to be used by the scan software. The 42-bit menu choice uses UMAX's Bit Enhancement Technology (BET) to allow for the capture of images with 14 bits per pixel rather than the standard 12 bits per pixel. General preferences near the bottom of the menu are used to set the retention or dismissal of tool and pallet settings after a scan, as well as preview controls, tip enabling and the type of internal calibration which will occur. Monitor Gamma allows you to perform a visual calibration of your monitor. If you are using a PowerLook 3000, you will find two additional menu choices for "Auto Focus" which can be selected in order to control the auto-focus capabilities of the PowerLook 3000. The Mac menu (left) shows these two additional menu choices (Lens Control and Auto Focus), found when MagicScan is controlling a PowerLook 3000. This feature is a fine tuning of the focus used when media is placed directly on the glass, or when scanning a reflective piece. We do not recommend that users turn this feature on when using frame holders, because it makes the scanning process longer, and doesn't add any additional focus. If you are not using a PowerLook 3000 scanner, these two menu choices will be absent from your settings menu.

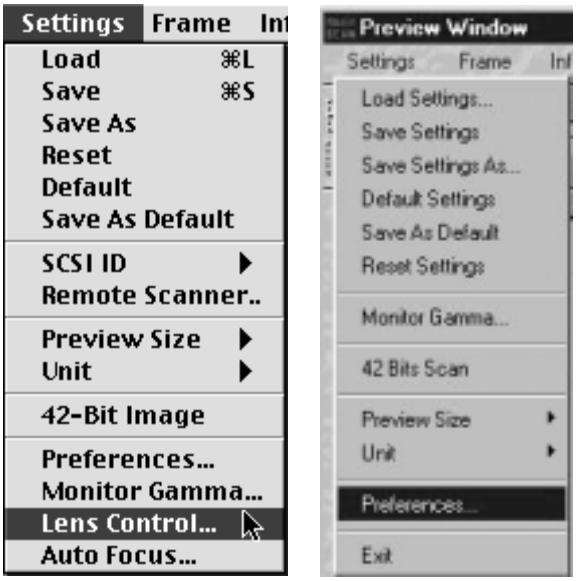


Figure 15 Settings Menu (Mac–left, Windows–right)

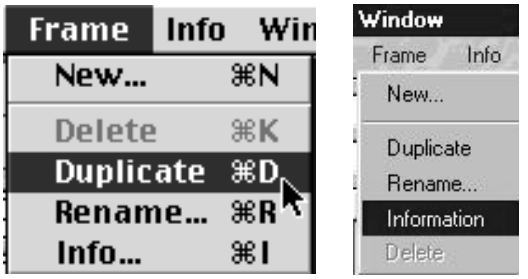


Figure 16 Frame Menu (Mac–left, Windows–right)

Frame menu

The Frame menu (Fig. 16) provides you with controls over your preview selection frames. You can make new selection frames, delete, duplicate, rename and get complete scan setup information about any selection. The frames affected by this menu appear in the Scan Job window.

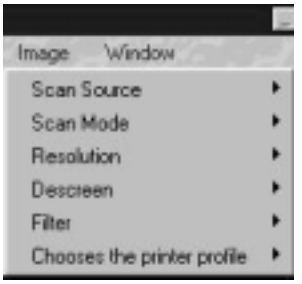


Figure 17 Image Menu

Image menu (Windows only)

The Image menu (Fig. 17) allows you adjust the scan setup controls, Scan source, Scan Mode, Resolution, Descreen, filter, and Printer Profile (used in automatic scan mode), through a menu. These are the same controls available to you though the Scanner Control Palette. (See the next section on MagicScan Palettes.)

Info menu

The Info menu (Fig. 18) allows you to obtain technical information about your scanner. You can control whether the ruler will appear around the preview window in this menu. It is here that you activate a histogram showing numeric and graphical display of the frequency and distribution of any selection's grayscale data. The info menu is also where you activate the help feature or select a view program.

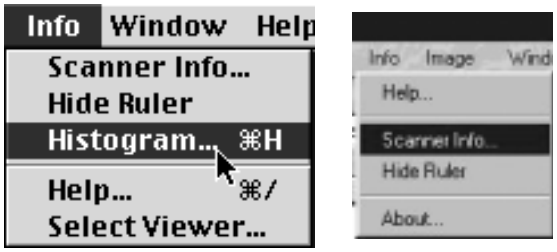


Figure 18 Info Menu (Mac–left, Windows–right)

Window menu

The Window menu (Fig. 19) allows you to control which palettes and windows are open at any given time. Notice that all five (5) choices have keyboard equivalents, Command Key (Mac) or Control Key (Windows) 1 through 5, which allow you to access or hide any of these windows or palettes.

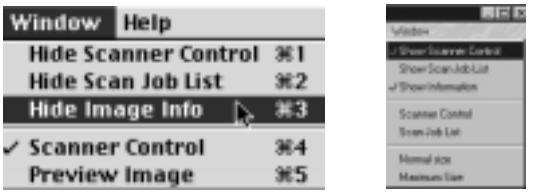


Figure 19 Window Menu (Mac–left, Windows–right)

Help menu (Mac only)

The Help menu (Fig. 20) allows you either to turn on or turn off help balloons, which provide you with basic information about objects over which you move your mouse.

Figure 20 Mac Help Menu

MagicScan Palettes and Windows

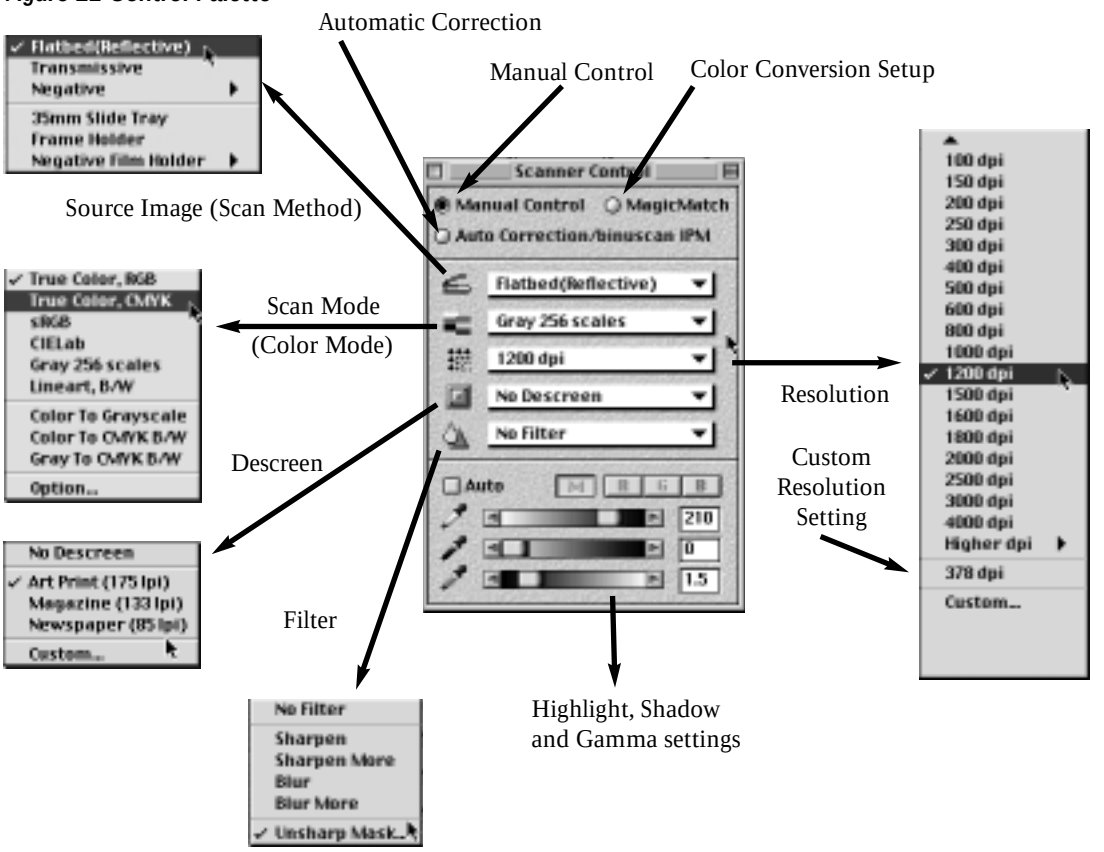
Scanner Control palette

The control palette (Fig. 21) is used to set up most of the basic scanner controls including: Auto Correction vs. Manual Control, color conversion profile activation, scan mode, scan resolution, descreening, and sharpening. If manual scanning is chosen, you should set all of these variables. We will learn how to control all of these functions in Chapter II of this manual "Image Capture and Editing."

Preview Image window

The resolution adjustable preview window (Fig. 22) is where a scalable preview of an image appears after a preview scan is completed. This preview image should be used to set up critical scanning functions for the second/final scan which is done after you complete your preview scan, including: image selection, scaling, rotation, setting

Figure 21 Control Palette

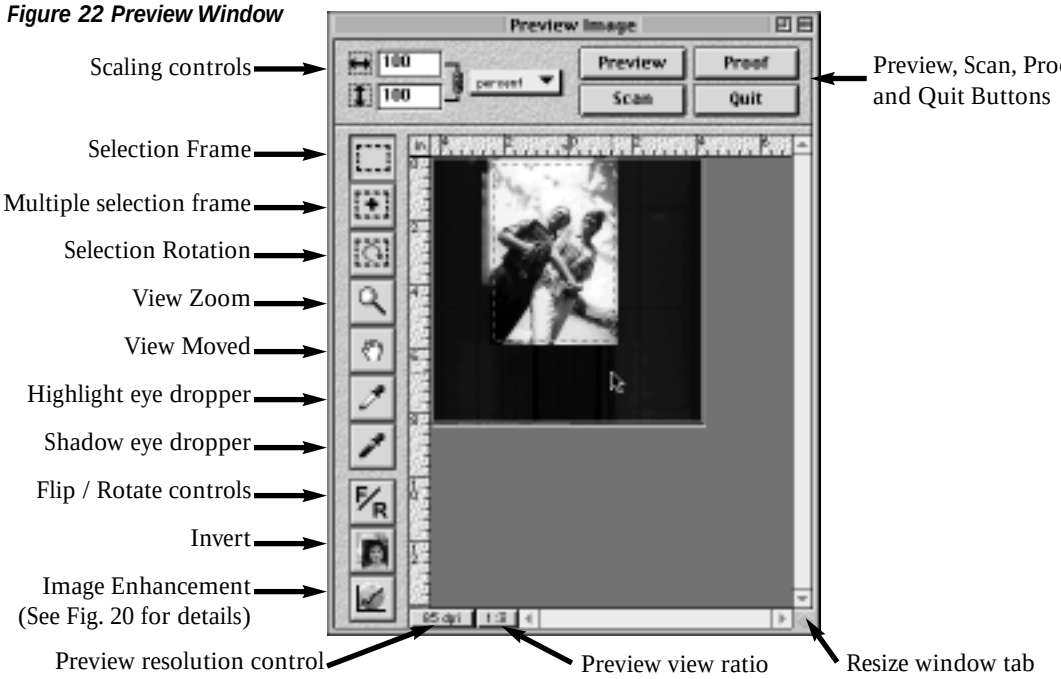


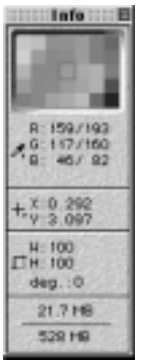
highlight and shadow points, flip/rotation, positive/negative control, image brightness and contrast, and color correction.

Info window

The Info Window (Fig. 23) displays a variety of handy information about the image in the preview window. It displays the RGB grayscale values of the portion of the image directly beneath the cursor. It also

Figure 22 Preview Window

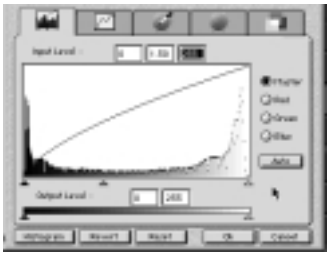




shows the x/y coordinates of the cursor on the preview image, the scaling which has been set to take place during the final scan, any rotation which has been assigned, and at the bottom, the size of the final scan and the amount of space available on the target storage drive.

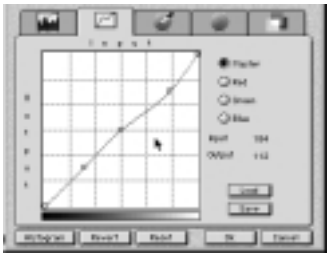
Figure 23 Info Window

MagicScan Enhancement tools



Editable Histogram and Gamma Curve

The MagicScan Image Enhancement tools (Fig. 24) are accessible by clicking on the bottom button in the lower left corner of the preview window (see Fig. 22). These tools provide you with a great deal of manual control over your scanned images. Use the *Gamma curve* portion of the first tool to calibrate your scanner. Use the editable histogram component of this tool to view and evaluate the distribution of grayscale values in an image, and to set your highlight and shadow point values. The *Curve tool* is used to control overall image brightness and contrast as well as to make adjustments to specific portions of images, and to make color adjustments to images. The *HSL Eye dropper tool* allows you to capture Hue, Saturation, and Lightness (HSL) data from images. The *HSL Adjustment tool* allows you to make whole image color cast adjustments. Use the *Color cast adjustment tool* to help remove color cast when calibrating your scanner. Use the Image Info tool (see Fig. 23) in conjunction with these Enhancement tools to create very accurate quantitative measurements and adjustments of your preview images to set up your final scans. The more you understand how these tools work and how to adjust them, the more direct and precise control you will have over your images.



Curve Tool

HSL Eye Dropper Tool

HSL Adjustment Tool

Color Cast Adjustment Tool

Figure 24 Image Enhancement Tool Windows

Scan Job List window

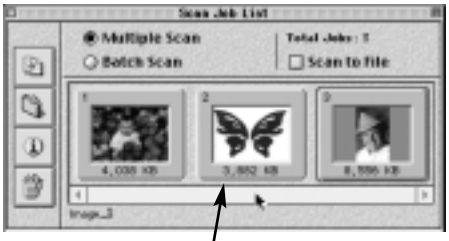
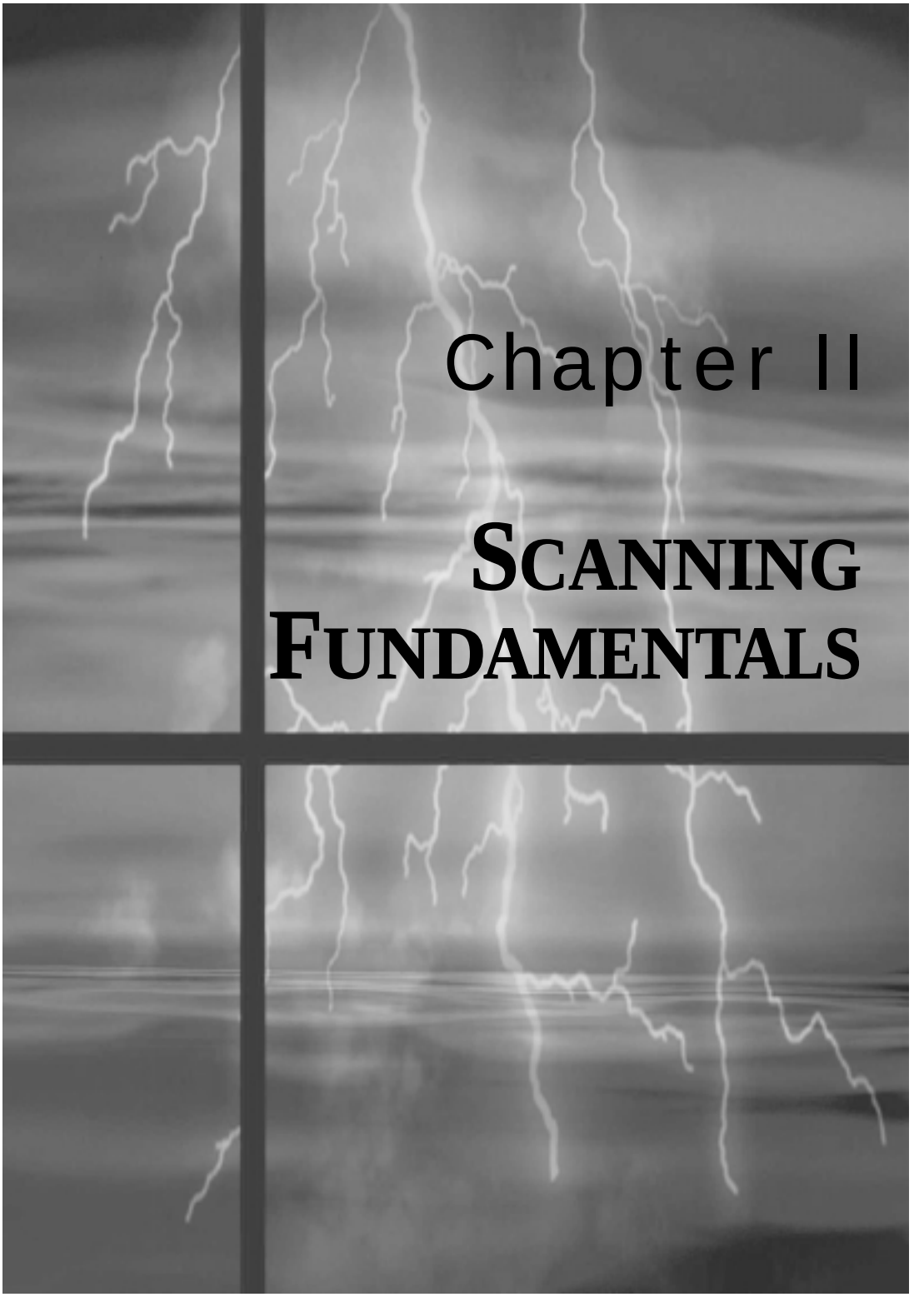


Figure 25 Scan Job Window

The Scan Job List Window (Fig. 25) is used for a thumbnail view of your selected images. Any rotation applied is shown in real time to these thumbnail images. This is also the window in which you can set up multiple or batch scans. Multiple scans are higher quality and batch scans are faster. This feature allows you to save time by scanning more than one image or view during any particular scanning event. If you prefer, MagicScan can scan your images to disk, rather than have them open after the scan, by clicking on the "Scan to File" Check box.



Chapter II

SCANNING FUNDAMENTALS

INTRODUCTION

Scanners and Scanning

The basic challenge of scanning

Figure 26 PowerLook 3000
The capabilities of the scanner as well as the quality of the original image and the skill of the scanner operator all contribute to the quality of the final image. Desktop scanners like the UMAX PowerLook 3000 provide desktop scanner operators with a professional quality scanning tool. Knowledge of the software and operation of the scanner are just as important as the capabilities of the scanner itself.

The scanning process is a challenge in image reproduction. Our goal of course is to produce a final scanned image with the highest possible quality. The quality of our final images depends upon a number of variables including: the quality of the original image, the capabilities of the scanner, and the skill of the scanner operator. The first variable, original image quality, is an important one. A skilled scanner operator with a high quality scanner can improve the quality of many images. Image corrections involving problems such as brightness, contrast and sharpness can be addressed. But even the highest quality scanners and most highly skilled scanner operators cannot reproduce image details which are not there. The poorer the quality of the original image, the harder we must work to produce a good final image. So it is always wise to start with a good quality image if possible. Once an image is chosen to be captured and reproduced by scanning, a scanner with the proper capabilities must be used in order for an image to be captured properly. If all you ever scan is simple black and white line art, a low-cost scanner with limited capabilities may be all you ever need. If your scanning requirements include the need to scan continuous tone images with lots of shadow detail, a much more capable scanner will be needed. Even the most highly skilled scanner operator cannot make up for a poor scanner. On the other hand, the best scanner in the world, in the hands of someone who does not know how to operate it, will rarely produce high quality images. The information in this scanning manual will help you improve your scanning knowledge and skills. This manual will also provide you with information on how to evaluate the capabilities of your scanner and the quality of your original images.

New language skills

If you are new to scanning, one of the first hurdles to get over is the terminology of scanning. Terms and concepts such as *input resolution, capture bit depth, dynamic range, unsharp mask, linearization,* and *neutralization* must be learned and understood in order to fully appreciate and address scanning challenges. This manual includes a complete glossary of scanning terms for you to use as a reference.

SCANNING CONCEPTS

Figure 27 Pixel Bricks
Pixels are the basic building blocks of a scanned image. The author calls them “pixel bricks” because pixel-based images are like brick walls, and the pixels are like the bricks. Scanners convert all images into pixels as they capture the image. Different scan modes will create images with various numbers of channels (rows) of “pixel bricks” with various numbers of bits of image data per pixel (bit depth). The top image above shows pixels with a bit depth of 1 bit per pixel. They contain either a 0 for the black pixels or a 1 for the white pixels. This is known as a 1-bit image. The second image above contains pixels with a bit depth of 8-bits per pixel, which provides us with the ability to store up to 256 shades of gray. This is an 8-bit image.

Building Blocks of Scanned Images

To obtain a fundamental understanding of scanners and scanned images, it is helpful to know about the basic "building blocks" of scanned images. Scanned images are constructed out of square building blocks called pixels. A scanned, pixel–based image is like a brick wall, where the square pixels are the bricks. (The author refers to them as pixel bricks.) These pixel bricks contain image information or data. This image information is stored in the form of bits of data. There are only two types of bits: 0’s and 1’s. The simplest type of pixel, a black or white pixel, will contain only 1 bit of image data. A black pixel may be assigned a bit value of 0, and a white pixel would then be assigned the opposite bit value of 1. More complex images such as grayscale and color images are constructed out of pixels which contain more than one bit of image data per pixel. The number of data bits which a pixel contains is known as its bit depth (Fig. 27). Note: sometimes you may see the terms *pixel depth* or *color depth* used to refer to the bit depth of a pixel.

Like a brick wall, our pixel-based images can contain one or more rows of pixel bricks. We call these rows of pixel bricks *channels*. The number of channels (rows of pixel bricks), and the bit depth of the pixels determine the type of image. For instance, a simple black and white line art image will have only one row of pixel bricks, with each pixel containing only 1 bit of image data. We refer to this as a 1-bit image. A grayscale image will also contain only one row, or channel, of pixels, but each pixel will contain at least 8-bits of image data which will allow that image to store 256 shades of gray (2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256). This is then referred to as an 8-bit image. An RGB (Red, Green, Blue) image contains three rows, or channels, of pixel bricks, each of which contains pixels with 8-bits of image data. The total bit depth of an RGB image is then 24 bits (3 x 8-bits per channel = 24 bits). The other type of image with which we routinely work is a CMYK (Cyan, Magenta, Yellow, Black) image. You guessed it, this type of image contains four, 8-bit channels for a total bit depth of 32 bits. (4 x 8-bits per pixel = 32 bits.)

It is a good idea to keep these basic building block ideas in mind when setting up a scan. When evaluating an original image to be scanned, determine which kind of image you would like the scanner to create, a 1-bit (black & white), an 8-bit (grayscale), a 24-bit (RGB) or 32-bit (CMYK) image. The

Figure 28 Grayscale Channels
All pixel-based images which are created by scanners and stored on computers are composed of grayscale pixels. Even "color" images are sandwiches of channels, or layers of grayscale pixels.
Above we see the three separate 8-bit grayscale channels (from top to bottom, red, green, and blue) which are the foundation building blocks of RGB "color" images. Each of these channels were created when the scanner viewed the original color photograph through three (RGB) separate filters. Proper capture of both grayscale and color images involves accurate capture and control of the grayscale pixels which compose these images.

scan mode you choose in the MagicScan software will determine the type of image the scanner will create.

No such thing as a color scanner!

As mentioned before, pixel-based images are composed of square pixels which contain image data in the form of bits. The number of bits of image data controls the number of shades of gray which an image can store. A 1-bit image can only store two shades of gray, black and white. An 8-bit image can store 256 shades of gray. But, regardless of the number of bits which an image contains, all of the bit-based image data is stored as 0's and 1's. This means that there is no real "color" data in any digital image. When we scan in RGB "True Color" or CMYK "True Color" we are not truly capturing a color image at all. All scanners and computers really understand is 0 and 1, black and white. All "color" images are actually created and stored on our computers as black and white images. When we scan in a "color" mode we are actually capturing three grayscale views of the original color images by viewing the image through three red, green, and blue color filters. The color we see on our monitors is the result of the colors generated at the monitor and not in the computer. The color values created by the monitor are controlled by the grayscale values which make up the three RGB channels in the "color" image. To prove this to yourself, open up any RGB image in Photoshop® or any other pixel-based image-editing software, and view each of the red, green, and blue channels separately. You will see that each channel contains only grayscale image data. What this means to us as scanner operators is that whether we are scanning black and white, grayscale, or color images, we must properly control the grayscale values of our pixels if we are to create high quality final images. The fact that all digital images are composed of grayscale actually makes our job somewhat easier.

Resolving resolution

Image resolution has been and remains a confusing mystery to many. This need not be so. One fundamental problem involves the improper use of terminology. Many people use the term *dpi* (dots per inch) as units of measurement when *ppi* (pixels per inch) is the more accurate term.

The first step in understanding resolution is to separate input resolution from output resolution. We then use the nature of the building blocks of our images to guide our use of terminology. *Input resolution* is used when discussing image capture, such as with scanners and dig-

Figure 29 Scan Resolution

Scanning or input resolution should be controlled through the scanning software. Scan resolutions for line art images are generally higher than for continuous tone images. Line art scan resolutions vary between 500 - 1200ppi. Continuous tone image scanning resolutions should be controlled by the line screen (lpi) at which the image will ultimately be printed. A formula of 1.5 –2.0 x lpi is typically used for scanning grayscale and color continuous tone images. For example, if an image which will be printed at 150 lpi, we would scan the image at between 1.5 and 2.0 x 150 = 225ppi – 300ppi. Line art images generally require higher resolution scans because the emphasis in scanning line art images is on edge reproduction. With continuous tone images, the emphasis is on grayscale reproduction, which is less resolution dependent.

ital cameras. Here we are working with pixels, not dots. There is not a dot to be seen in any scanned image, nothing but pixels for as far as the eye can see! So, when discussing the resolution of pixel-based images, we should always use pixel-based terminology, such as *ppi* (pixels per inch). The term *ppi* is the most commonly used correct terminology and will be used here. (Note: some drum scanners and digital camera software use the term *Res.* which equal pixels per mm.) The term *200ppi* refers to 200 pixels per inch. This means that our image is composed of 200 pixels in every inch, horizontally and vertically. This also means that each pixel will be 1/200th inch on a side. The higher the resolution of an image, the smaller and more numerous are the pixels. Smaller pixels generally lead to sharper images. Smaller pixels also lead to larger files sizes and longer printing times. We usually try to strike a balance between resolution and file sizes/printing times. There are diminishing returns when we use too much resolution.

When we reproduce our images by printing them on laser printers or other print devices, the nature of an image's building blocks changes as will our terminology. During the printing process our once pixel-based images are converted into patterns of spots and dots. Spots are smaller than dots. Individual spots are used for printing line art and type images where edge sharpness is at a premium. The term dpi here really refers to the spots per inch of the print device. For instance a 300 "dpi" laser printer is really a 300 spot per inch laser printer. This refers to the size of the image spot which is created by the printing device. A 300 "dpi" laser printer creates an image spot which is 1/300th inch in diameter. Most printing companies print with higher resolution printing devices which print in the range of 2400 "dpi" or spots per inch. We will typically scan most line art images in the range of 500ppi – 1200ppi, which is higher than what we will typically use for continuous tone images. This is because the emphasis in line art scanning is on edge reproduction, which requires smaller spots.

The second printing output resolution building block is the true dot, known as the halftone dot. This halftone dot is much larger than the image spot; in fact, a halftone dot is constructed from a group of image spots. Halftone dots are used in the re-creation of continuous tone images such as grayscale and color photographs. The important output terminology here is *halftone dots per inch*, more commonly known as *lpi* (lines per inch) or line screen. This lpi output resolution is an important number to know, because the output resolution (lpi) of the printing device should control the input resolution (ppi) at which we scan our contone images. The basic guiding principle here is that we need to make sure that we have enough pixel information

in our scanned image to produce a high quality halftone dot pattern when we print. The basic scan resolution formula we use is 1.5 x lpi. So, if we are printing at 150lpi we should scan our image at ~ 225ppi. If you are scanning for the Web you can scan at 72ppi, the resolution of most monitors, or you can scan for print and then down sample.

Scaling and resolution

All of the above assumes we are not scaling our image after the scan. For complex line art and continuous tone (photographic) images which will remain as pixel-based images after they are scanned, it is best to allow the scanner to perform the scaling. If you scale your images during the scanning process, choose the final resolution you prefer, for example 200ppi, and the percentage of scaling you would like, for example 200%, and allow the scanner to do the rest. In this case the scanner would scan your image at 400ppi, size your image up to 200% and provide you with an image which is 200% larger at 200ppi. Line art images which will be converted into vectors should generally be scaled after their conversion to vectors. Please see the step-by-step instructions later in this chapter for specific resolution recommendations for various kinds of images.

SCANNING CHALLENGES

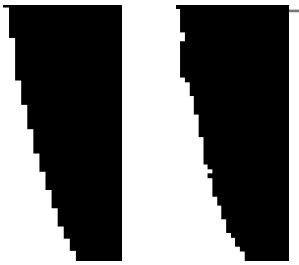


Figure 30 Optical vs Interpolated Resolution
On the left is a line art edge captured using the optical resolution of the scanner (600ppi). On the right is the same edge captured using an interpolated resolution (1000ppi.) Note the greater "raggedness" of the lower quality, interpolated edge.

Many people regard their scanners merely as image capture devices. Their standard mode of operation is simply to capture an image with the scanner and then perform nearly all of the image correction functions after the scan in an image-editing program such as Adobe® Photoshop®. Back in the early days of desktop publishing when scanners were low-quality and scanner control software was nonexistent, this was a viable approach. Today, however, our desktop scanners are far more capable and our software is much more robust. Our approach now should be to perform as many image-correction functions during the scan as possible, and save a minimal amount of work for Photoshop® or other image-editing software. Adjusting most key image functions, such as image resolution, calibration, highlight and shadow details, brightness, contrast, and in some cases image sharpening, should be performed during the scan. Performing these fundamental functions during the scanning process will result in higher image quality and faster production times. Let's review some of the key image control variables.

Figure 31 Scaling Setup
MagicScan's scaling controls are found in the upper left-hand corner of the Preview window (top). Units can be chosen to suit your needs. Assign the final resolution you would like your image to have, here 200ppi (bottom), and the scaling which you would like the scanner to perform, here 200%. The scanner will do the rest. MagicScan will direct the scanner to scan at 400ppi, and resize the image 200%. This resizing will lower the image resolution to the requested 200ppi.

Image resolution: Optical resolution

Most scanners provide you with a wide range of resolution choices. For instance, a PowerLook III will allow you to scan images from 1ppi to 9600ppi. Within this range there is a preferred set of resolutions related to the optical or hardware resolution of the scanner, or the resolution at which the scanner actually captures an image without interpolation. *Interpolation* is the generation of new pixels from data which already exists. For instance, the optical resolution of the PowerLook III is 1200ppi. This means that a PowerLook III will capture pixels which are 1/1200" on a side. When the PowerLook III is used at 1200ppi or some whole number division of that, such as 600ppi (1/2 of 1200), the PowerLook III will work fastest and most accurately. If we scan a non-optical resolution, such as 500ppi or 1000ppi, the scanner is forced to interpolate, or make up pixels. Interpolation leads to less accurate pixels and longer scan times, so it is usually best to scan at the optical resolution or some whole number division thereof. See Fig. 30 for a contrast between a line art edge which is captured as an optical edge versus an interpolated edge. In addition to creating a smoother pixel-based edge, the smoother optical edge will result in cleaner, less complex outlines if we convert the pixel-based image to a vector-based image. Please see the step-by-step line art scanning techniques in Chapter III of this manual for more detailed instructions on scanning various types of line art images.

Scaling

A topic closely related to image resolution is image scaling. We often want or need to change the size or scale of an image to suit the design requirements of a document. An original image may be 4" x 5" but we want to reproduce it at 8" x 10"; this would require that we double both the height and width of the image, or scale it 200%. Scaling can be done in several places, including during the scan, or after the scan in an image-editing application such as Photoshop® or even through a page layout program. We should avoid performing final scaling in a page layout application, as these programs have no ability to change the actual pixels in an image. The best place to perform the scaling of an image is during the scan. Your scanner has more data to work with, so it does a better job than an image-editing program, and it will perform the scaling faster. Scaling is controlled by deciding the final resolution of your image, for example 200ppi, and then assigning a scaling factor, for example 200% , or a final numeric size. In this example if we started with a 4" x 5" original image, your scanner will then scan your image at 400ppi and then resize your image 200% to 8"x 10" which will then lower the image resolu-

Figure 32 Calibration
On the left is an image scanned on an uncalibrated scanner. On the right is the same image scanned on the same scanner with the same settings, but this time after it has been linearized. Notice how overall image brightness, contrast, and shadow details are improved through calibration.

Figure 33 Maximum Density (Dmax)
On the left is an image scanned with a scanner which had a Dmax of 2.5. On the right is the same image scanned with the PowerLook III, which has a Dmax, or maximum density, of 3.4. Note the much improved shadow details captured by the PowerLook III. Look specifically at the hair, and you will see how much farther along into her roots you can see.

tion to your desired resolution of 200ppi. The final result will be a 200ppi 8" x 10" image (Fig.31).

Calibration

Every image capture device, including scanners, no matter what their cost or capabilities, needs to be calibrated to assure consistent results. Nearly all scanners tend to capture images darker than they actually are. And when working in color mode, uncalibrated scanners can add color cast to color images. Each device is different and varies over time with variables such as temperature and bulb age. Calibration helps to standardize the capture response of the scanner, and improve the overall quality of your scanned images (Fig. 32). Calibration is initiated by scanning a target which contains swatches with known grayscale values. The grayscale values which the scanner "sees" are then compared with the actual values of the target. The scanner is then adjusted or corrected so that it captures the target values correctly. To assure accurate and consistent scanning of your images, calibration should be performed prior to each scan session. See the sections on how to calibrate your scanner, beginning on pages 24 and 28.

Dynamic range

The measure of a scanner's ability to capture a range of grayscale values is known as its dynamic range. Dynamic range varies on a density or "D" scale from 0 to 4.0 with each integer step being a ten (10) fold increase in grayscale recognition capacity, with 4.0 density range being the most capable. The lower "D" number is known as the Dynamic Range Minimum, or *Dmin*. The Dmin is a measure of the lightest grayscale values which a scanner can recognize. The higher "D" number is known as the Dynamic Range Maximum or *Dmax*. The Dmax is a measure of the darkest grayscale values which a scanner can distinguish. Most scanners perform well in the highlight regions; that is, they have acceptable Dmins. Only the higher quality scanners perform well when it comes to distinguishing shadow detail. Scanners with a high Dmax, >3.0, can see a lot of shadow detail, while those with poor Dmax, <3.0, can see little shadow detail. An example of this difference can be seen in Fig. 33. A scanner's Dmax is largely determined by the quality of the CCD used in the scanner, so this is not an adjustable feature. However, a properly calibrated scanner allows us to take full advantage of its dynamic range. Increased dynamic range is one of the capabilities you pay for when you purchase more expensive scanners. Your scanner should have a Dmax of at least 3.0 to be an effective tool for capturing good shadow details.

Figure 34 Image Brightness and Contrast
On the left is an image scanned without proper attention to controlling the setting of highlights, shadows, or contrast. On the right the same image has been re-scanned after setting highlight and shadow points using an editable histogram and adjusting overall brightness and contrast using a curve adjustment.

Image brightness

The overall brightness of an image is determined by several factors, including the brightness of the original image, calibration of the scanner, the setting of the highlight and shadow points for each image, as well as any overall brightness adjustment we may make. We will use a gamma curve to calibrate the scanner, an editable histogram to set highlight and shadow points, and a normal curve tool to adjust overall brightness. Perhaps the two most critical data points to set in any image are its highlight and shadow points. Setting these two points involves identifying the lightest and darkest points in an image which has details, and assigning to these areas specific highlight and shadow grayscale values. The grayscale values we assign will be governed by the output devices on which we will print our images. Typical highlight and shadow values for commercial printing are 5% gray for the highlight detail image areas and 95% gray for the shadow detail areas. These values can vary widely for other devices (Fig. 34).

Image contrast

Image contrast is adjusted by controlling the distribution of grayscale values in an image. If grayscale values are concentrated in the highlight and shadow portions of the image, then the image will have high overall contrast. If, on the other hand, an image has much of its grayscale value concentrated in the midtone region of the image, then its overall contrast will be low. Adjusting an image's contrast is a key element in controlling the overall quality of an image (Fig. 34).The distribution of grayscale values to control the overall contrast of an image will be controlled through the adjustment of a normal curve , which will be illustrated in Chapter III of this manual. Contrast adjustments should normally be performed after the highlight and shadow points of an image are set.

Figure 35 Image Sharpness
On the left is a portion of an image which has been scanned properly but not sharpened. On the right is the same scanned image, with sharpening applied. Note how the high contrast portions of the right image, such as the eyes, eye brows, and hat fabric are sharper and appear to be in better focus.

Image sharpness

One of the universal characteristics of all scanners is that they will soften images when they work in anything other than 1 bit mode. For example, a sharply focused portrait will be softened when it is scanned. The reason for this is that scanners sample images rather than copy them, and sampling produces intermediate grayscale values, which in turn leads to softening of edges. As we will see, this softening can be an advantage when we are scanning detailed line art. With continuous tone images, like portrait photographs, this softening needs to be removed. Softening can be corrected through the application of sharpening controls, and specifically the use of

unsharp masking. Unsharp masking allows us to selectively sharpen the higher contrast edges of an image in the reverse manner of how a scanner softens them (see Fig. 35).

Color control

As discussed earlier, color images are really constructed out of "sandwiches" of grayscale images. Therefore the "color" (RGB) values in images are controlled by the grayscale values of the pixels which comprise the "color" layers. So to control the color values in an image, we adjust the grayscale values of its pixels. The key color correction technique we use when capturing color images is called *neutralization*. In neutralization we adjust the grayscale (RGB) values of neutral, that is gray areas, of an image, so that the RGB values are equal. When we correct the RGB grayscale values in neutral (gray) areas of color images, we are also correcting the RGB values in other portions of the color image as well. So, neutralization of color images tends to adjust color values all across a color image. For color correction tips on specific image types, see Chapter III of this manual.

Dot Gain

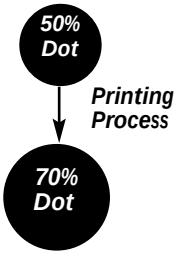


Figure 36 Dot Gain
During the printing process the size of halftone dots tends to increase as ink spreads out, causing photographs to darken. Dot gain tends to be greatest in the midtone region, where the percentage of dot gain may be 20 percent or more.

The inks and toners which we use in the printing process tend to spread out when they are applied to paper. When this spreading ink is used to form the halftone dots which we create to simulate grayscale values, these halftone dots grow in size. In turn, the larger halftone dots create the impression of darker grayscale values. The net of all this is that our images tend to print darker than they scan.

To further complicate the issue, our printing inks and toners react differently on different media. An image printed on coated stock will be much sharper and brighter than an image printed on uncoated stock. Inks applied to uncoated paper are absorbed more and tend to spread out more than inks applied to coated paper. This spreading out of ink and toner is known as *dot gain*. Dot gain can vary from as little as five percent on hard glossy stock to as much as 30 percent on porous newsprint or laser printers (see Fig. 36). Dot gain tends to be greatest in the midtones of an image and decrease toward the highlight and shadow portions of an image. Dot gain must be compensated for before an image is printed. Dot gain correction can take place either during the scan or in the post scan through an image-editing application, during gamut conversion for color images, or even during the RIPing process. But regardless of where dot correction occurs, it usually involves the application of a curve which lightens the image prior to printing.

Tonal regions

When describing the various tonal regions in an image, we use five terms: *highlight, quartertone, midtone, three-quartertone* and *shadow*. These are general terms which allow us to easily and quickly identify and refer to the five major tonal regions of an image. The *highlight* region generally encompasses the lightest portions of an image ranging from pure white 100% up to around 10 – 15 % grayscale. The *quartertone* typically centers around the 25% grayscale portion of an image. The *midtone* refers to the middle portion of an image, with a center on 50% grayscale. The *three-quartertone* is found around 75% grayscale while the *shadow* generally refers to darker portions of an images, typically from 80% to 100% gray. While there are no hard and fast tonal range definitions, each term refers to the range of tonal values within 10 – 15% of the center value. For instance, the quarter tone refers to grayscale values which roughly range from 10% gray to 35% gray. So there is some obvious overlap between the boundaries of the tonal range areas. Controlling the grayscale values in these five tonal regions is the key to high quality images.

Scanning for multiple purposes

Most scanning used to be done with one primary output device in mind, a commercial printing press. Today we have access to a dizzying and growing array of output devices. So we often scan for multiple uses. Our images are often output on more than one device. We may print our images on several different printers, image them to film recorders and ultimately place them on CD's or Web pages. Because of this it is preferable to create images which are not device-specific, and can be used or modified for use on a variety of different devices. As a result you should scan for the highest quality you need, and then re-purpose the image for lower quality uses. You may want to scan your original images at 200 – 300ppi as an RGB or CIE-based image and then convert them to other file color modes and/or lower resolutions for other purposes. See the table on the following page for a file format overview.

File formats

Pixel-based images which are created by scanners can be saved in many different file formats. It is useful to think of a file format as a container into which image components, such as pixels and/or vectors, are stored. The file format we choose for an image should be determined by how the image will be used. For example, if we are to use our images for printing to a PostScript printer then a pixel-based

TIFF or EPS would be most appropriate. If, however, our images will be used for placement on a Web page, then a GIF, JPEG, PNG or SWF file format would be most appropriate. Some file formats such as PCX, PICT and WMF tend to be more platform specific and less flexible than TIFF's and are therefore less desirable for use as a standard file format. We recommend that you initially save your images in the TIFF format. The TIFF format is a flexible, pixel-based file format which is compatible with use on Mac, Windows, and UNIX systems for print. If you reuse and/or recreate your images for other purposes you may change the file format of an image. Below are some suggestions for file formats, color spaces, resolutions and use.

TIFF: a general pixel-based format used in PostScript printing, for grayscale and CMYK, at 200-300ppi for both desktop and commercial printing.

EPS (pixel-based): an alternative to the TIFF format. Some RIPs, workflows, and applications prefer this format for printing pixel-based images. Pixel-based EPS's are typically used in grayscale and CMYK images at 200-300ppi for desktop and commercial printing.

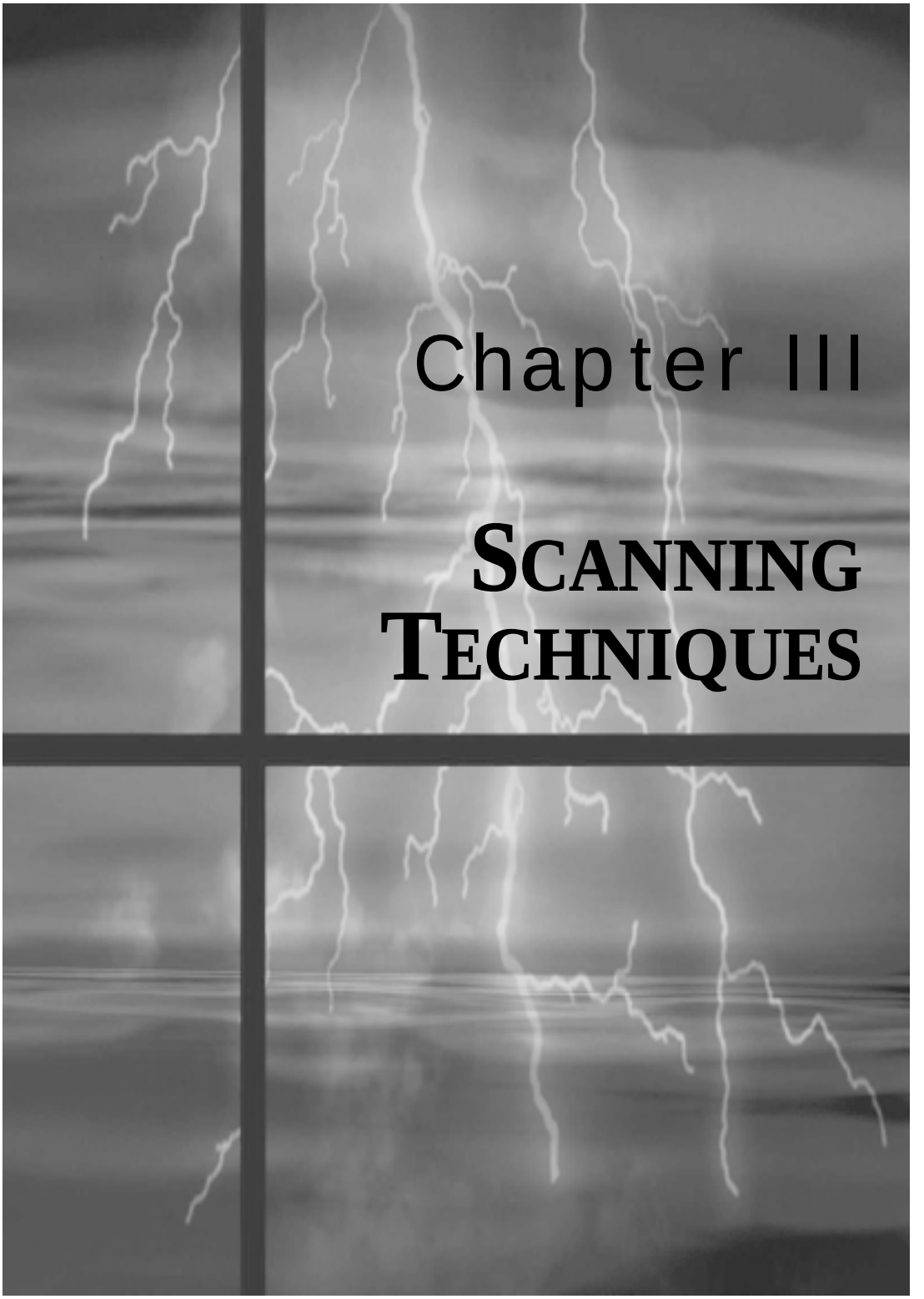
EPS (vector-based): the preferred format for vector-based images which will be printed on PostScript printers. This type of image file format is used for grayscale, spot colors or CMYK for desktop and commercial printing. Pixel-based TIFF's can be converted into vector-based EPS's through applications like Adobe® Streamline®.

GIF: a pixel-based image format used on the Web. This type of image file format is used for grayscale, and Index color images (≤8bits), typically at 72ppi.

JPEG: a pixel-based format commonly used on the Web for viewing and image transfer. This type of image file format is used mainly for grayscale and 24bit RGB images. JPEG can also be used in CMYK format for storage and printing of high resolution files, but a JPEG image should be converted into a CMYK, TIFF, or EPS prior to printing.

File naming

Placing a proper three-character, lower-case format identification extension or suffix at the end of your file names. Examples include: .tif for TIFF, .eps for EPS files, .gif for GIF files, and .jpg for JPEG files. This three character extension is not only important for the visual recognition of the file format, but is also necessary for some computers to recognize the file format. The same file format should be selected from the drop down menu in the save window.



Chapter III

SCANNING TECHNIQUES

LINE ART SCANNING

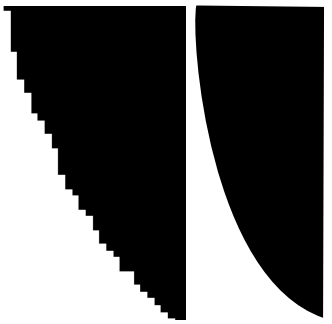


Figure 37 Pixel vs Vector Art
On the left is a typical pixel-based edge. The individual building block pixels can be easily seen on this angled edge. On the right is the same edge constructed from a vector. Note that the vector edge does not show the typical visual stair stepping associated with the pixel-based edge. The vector edge is not only sharper and cleaner than the pixel-based edge, but it can be scaled and rotated without loss of edge quality. It is often a good idea to convert simple and intermediate detailed pixel-based line art into vector-based images, and especially if they will be scaled and/or rotated. One of the keys to creating smooth-edged vector line art from pixel-based images is to scan at the optical resolution of your scanner. Detailed line art should remain as pixels.

When we are challenged with capturing and reproducing line art images, our main focus needs to be *edge reproduction*. Scanning line art using the optical resolution of our scanners is often a key factor in accurate edge reproduction. Converting pixel-based line art to vector-based images can often improve image edge quality and editability.

Pixels vs. vectors

One of the decisions we should make early when capturing line art is whether we want our line art images to end up as pixel-based images or as vector-based images. All of our scanned images will be initially created as pixel-based images, as this is the only format in which scanners capture images. Some line art images will work best when they are converted into vector-based images using a pixel-to-vector conversion program such as Adobe's® Streamline® or similar software.

Vector-based images have the advantage of sharper, cleaner edges, and smaller file sizes compared to pixel-based images. In addition, vector-based line art images can be scaled, rotated and skewed without compromising any edge quality. The primary advantage of pixel-based images is their ability to display details. So the primary characteristic we will use to determine whether an image will be ultimately recreated as a pixel or vector-based image is the detail in the original image. Simple line art images will often be converted into vectors to take advantage of the enhanced editing features of vectors, while high detail images need to be captured and and maintained as pixel-based images. See Fig. 37 for a comparison of a pixel and a vector image.

Resolution requirements for line art images

Resolution requirements for line art images are generally higher than those required for contone photographic scanning. Line art scanning resolution ranges from 500 – 600ppi (for simple line art which will be converted into vectors) to 1000 - 1200ppi (for detailed line art which will remain as pixels). In either case, and particularly for the simple line art which will be converted into vectors, it is important to scan at the optical (sometimes called the *hardware*) resolution of the scanner or some whole number division thereof. For instance, using a scanner which has an optical resolution of 1200ppi, scan at 600ppi (1/2 of the 1200ppi) for simple line art images which will be converted into vectors, and 1200ppi for more the complex line art images which will remain as pixels. Scanning at the optical resolution of the scanner

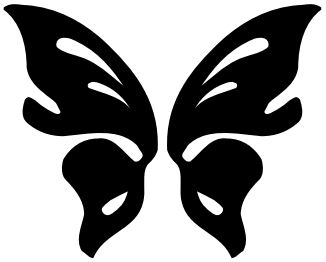


Figure 38 Simple, Low Detail Line Art

Simple line art, like this butterfly, has large areas with few details. Scanning at the optical resolution of the scanner, or 1/2 or 1/3 of that number, is the key to edge consistency, which is important for quick and clean conversion to vector line art. A range of 300 – 600ppi is generally sufficient for simple line art.

Figure 39 Streamline Setup

Key Settings:

Noise suppression = 10
Tolerance = loose (5.0)
Curved & Straight = curved (5.0)

results in cleaner, smoother edges which are easier to convert into high quality vector art. In addition, scanners operate faster when they are used at their optical resolutions. All line art scan resolutions recommended in the following step-by-step tutorials are based upon an optical resolution of 1200ppi.

Following are step-by-step procedures for the capture of various kinds of line art.

Simple black and white line art concerns

For simple, low detail line art including images such as the one in Fig. 38, our emphasis, as previously mentioned, is on *edge reproduction*. The key to good edge reproduction with low detail line art is to scann at the optical resolution of your scanner.

Low detail line art technique

First, clean your scanner bed and place your simple line art image squarely on the scan bed. (*Note: the simple line art image in Fig. 38 is available as a printed practice image on the last page of this manual.)*

Note that with the PowerLook 3000 a rubber mat is provided to flatten and stabilize reflective images.

1) Set scan mode to 1-bit B&W (Lineart) and scaling to 100%. Any necessary scaling will be done after conversion to vector line art. Scanning at 100% will provide the most consistent, and therefore smoothest edge, which is important for conversion to vector line art with clean smooth edges.
2) Preview at low resolution (72ppi) for preview of image.
3) Crop the portion of the image you want to scan.
4) Set scanner resolution at 500-700ppi or about half of your scanner's optical resolution. (For instance, the PowerLook III has an optical or hardware resolution of 1200 by 2400ppi, so you would set the resolution at 600ppi.)
5) Double click on the thumbnail image in the Scan Job List window to set the image to be saved as a pixel-based TIFF. A TIFF (.tif) is a pixel-based file format which works equally well on both Mac and Windows platforms.
6) Scan image at this higher resolution for the second and final scan.
7) Open image in Streamline®* for conversion to vector-based image. This conversion allows for geometric manipulation such as scaling and rotation without degradation of edge quality, easier edit-

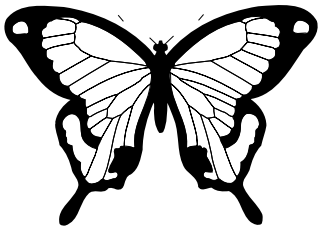


Figure 40 Intermediate Detail Line Art

More detailed line art images like this butterfly often have thinner lines and show more details than simple line art images (like the image in Fig 28). Scanning at the optical resolution of the scanner, or 1/2 or 1/3 of that number, is the key to edge consistency, which is important for quick and clean conversion to vector line art. A range of 500 – 600ppi is generally required for most intermediate detail line art. Resolutions below 500ppi are generally not sufficient for intermediate detail images.

Figure 41 Threshold Dialog

Threshold is used here to control the thickness of the fine lines in the grayscale version of the intermediate detail butterfly image above. The threshold pointer is moved right or left to increase or decrease line thickness. This tool is acquired in Photoshop® under the Image menu (Image ➔ Adjust ➔ Threshold).

ing such as color assignments, and dramatic file size reductions.

8) Choose "Conversion Setup" from Streamline's® "Options" menu. (Options menu ' Adjust) the settings as follows: "Method" = Outline; "Tolerance" = Loose (5); "Lines" = Curved and straight = Curved (5.0). (Fig. 39)

9) Save as vector graphic in Illustrator EPS format.

10) You may now open your newly created vector based image in your choice of drawing applications (Freehand, Illustrator or Corel Draw) to edit this image (Assign colors, scale, rotate etc.).

*Streamline® is a dedicated pixel-to-vector conversion program available from Adobe® in both Mac and Windows versions. And your MagicScan plug-in or Twain will work fine in Streamline®, so you are able to scan directly into Streamline®!

Intermediate detail line art concerns

More complex line art, such as the intermediate detail butterfly in Fig. 40, often has thinner lines and more detail than simple line art. This added detail and fineness of line usually requires a bit more resolution and greater pixel depth to capture the image accurately.

First, clean your scanner bed and place your Intermediate detail line art image squarely on scan bed.(*Note: the intermediate detail line art image in Fig. 40 is available as a printed practice image on the last page of this manual.)*

Next, scan and manipulate the intermediate detail butterfly in Fig. 31 using the same steps and techniques detailed in the previous simple line art section.

Technique variation for intermediate detail line art

For line art images which have some detail possibly difficult to capture, such as some thin lines, or for line art images whose edges you would like to adjust in terms of edge thickness or detail, try the following scanning and image-editing variation.

Steps 1-6: Follow the same first six (6) steps as we did for simple line art in the previous exercise, with one change. Instead of setting the scan mode to 1-bit line art, set scan mode to 8-bit (Gray 256 scales). This will create editable grayscale edges which will allow us to control the size of our line art edges in an image-editing program such as Photoshop®, after we complete the scan. If you have fine lines you may want to scan at 1000-1200ppi instead of the 500-700ppi range. Try the lower resolution first to save file size.

Figure 42 Detailed Line Art
The most complex line art images like this butterfly have more details than simple and intermediate complexity line art images (Figs. 28 and 30). Scanning at higher resolutions (1000 – 1200ppi) is generally required in order to capture the fine details. The real key to capturing and controlling details in images like these is to scan in 8-bit (grayscale) or higher mode. This allows the image to be edited after the scan in an image editing application such as Photoshop®.

7) Open the grayscale line art image in Photoshop® using the Threshold tool (Image menu ‘ Adjust ‘ Threshold) to adjust the line thickness edge sharpness. Move the Threshold midpoint to adjust the edge thickness of the line art image edges (Fig. 41).

8) After thresholding, convert your image to 1-bit black and white mode. In Photoshop® choose (Image Menu ‘ Mode ‘ Bitmap). This will convert your image into a 1-bit black and white image, which will reduce your file size by a factor of eight and make it easier and faster to work with.

9) If you would like to now convert your pixel-based line art image to vectors, using Adobe® Streamline® to allow for easier editing, follow steps 7-10 as we did for simple line art in the previous exercise, in order to convert.

10) You may now open your newly-created vector based image in your choice of drawing applications (Freehand®, Illustrator® or Corel Draw®) to edit this image (Assign colors, scale, rotate etc.).

High detail line art issues

The most complex line art, like this high detail butterfly in Fig. 42, will have a lot of detail. This kind of detail can be difficult for a scanner to capture at low resolution and/or if the detailed areas are close together. To make sure you can capture all the details possible, and to give you the ability to control the details after the scan, you should scan at high resolution (1200-1400ppi) and capture the image in 8-bit (grayscale) mode. The grayscale version of the line art image can then be controlled and edited in Photoshop®.

High detail line art technique

First, clean your scanner bed and place your complex line art image squarely on scan bed. (*Note: the detailed line art image in Fig. 42 is available as a printed practice image on the last page of this manual.)*

1) Set scan mode to 8-bit (grayscale) and scaling to appropriate size (Scaling by the scanner here is appropriate because no conversion to vector art will occur).

2) Preview scan at low resolution (72ppi) for preview of image.

3) Crop the portion of the image you want to scan.

4) Set scanner resolution at the optical resolution of the scanner (1200-1400ppi).

5) Double click on the thumbnail image in the Scan Job List window

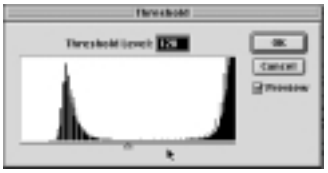


Figure 43 Threshold Dialog
Threshold is used here to control the size and spacing of the fine dot details in the grayscale version of the high detail butterfly image above. The threshold pointer is moved right or left to increase or decrease size and spacing of the detail dots. This tool is acquired in Photoshop® under the Image menu (Image ➔ Adjust ➔ Threshold).

Figure 44 Low Edge Quality Line Art
Low edge quality line art has poorly defined edges. The key to being able to control images like these is to scan in 8-bit or higher mode, allowing the use of unsharp masking and thresholding to help define the details of the edges. Be sure to convert to 1-bit prior to printing, unless you intend to color the image, or you would like to print the image with soft edges.

to set the image to be saved as a pixel-based TIFF.

6) Scan image at this higher resolution for second and final scan.

7) Make a copy of the image to be used for editing purposes. Save the original 8-bit grayscale version of the image as an unaltered file, so that you can return to it later.

8) In Photoshop® you may also use the Unsharp mask tool (Filter menu ' Sharpen ' Unsharp mask) to control image details and line thickness. Try various unsharp mask settings to control the thickness of the line art lines. Experiment with the Amount = 300–500, Radius 10–50, and Threshold 0 –10 (Fig.43)

9) To fine tune your line art and/or increase the image contrast, experiment with the Threshold tool in Photoshop® (Image ' Adjust ' Threshold) to adjust the image detail. Move the threshold midpoint left and right to see the impact on the image details.

10) Convert image to 1-bit B&W (Image ' Mode ' Bitmap) to lower file size and allow sharper edges when printing.

11) For softer edges do not use the Threshold tool and do not convert your image to 1-bit black and white.

12) Save final image as pixel-based TIFF again. There will be no conversion to vector art for high detail images.

Low edge quality line art issues

Low edge quality line art is not a comment on the artistic quality, but rather a description of the technical quality of the edge. A low quality edge is one which is poorly defined. While poor edge quality often occurs in poor quality images such as faxed or copied images, they can also occur in some high quality images such as the soft edges of the pencil drawing seen in Fig 44. Most poor edge quality images will remain as pixel-based graphics for editing, although sometimes edged consistency increases to the point where these images can be converted to vectors if that is desirable.

Low edge quality line art technique

First, clean your scanner bed and place your low edge quality line art image squarely on scan bed. (*Note: the low edge quality line art image in Fig. 44 is available as a printed practice image on the last page of this manual.)*

1) Set scan mode to 8-bit mode for B&W line art or 24-bit, or higher, (RGB) and scaling to desired size.

2) Preview scan at low resolution (72ppi).

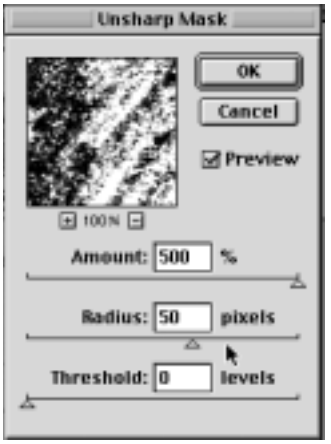


Figure 45 Sharpened Low Quality Edge

After application of a large amount of unsharp mask (~ 500% with a radius of 50) the definition and visibility of the image is much improved. You can vary the amount and radius of the unsharp mask to vary the visual effect. The whole key to having this editability is to scan in 8-bit (grayscale) mode rather than 1-bit (black and white line art) mode. Contrast of the image can be further increased, as it was here, by converting to 1-bit black and white mode.

3) Crop the portion of the image you want to scan.

4) Set scanner resolution at 600ppi or higher, depending upon your scanner's optical resolution and the detail in the image.

5) Double click on the thumbnail image in the Scan Job List window to set the image to be saved as a pixel-based TIFF.

6) Scan this image at this higher resolution for second and final scan.

7) In Photoshop®, the Unsharp mask tool (Filters ' Sharpen ' Unsharp mask) may be used to control image detail and line thickness. Unsharp mask setting ranges: Amount = 100–500, Radius 1–50, Threshold 0 –10 depending upon your desired results (Fig. 45).

8) The look you want will determine the next step. If you want to have a bit of softness to your image edges, keep your image in 8-bit (grayscale) mode. If you want to create a stark high contrast black and white only image with no grayscale or color component, you can process your image through Threshold (Image menu ' Adjust ' Threshold) and/or convert the image to 1-bit (black and white) mode (Image ' Mode ' bitmap) in Photoshop®.

Color line art image issues

Once you have mastered the line art techniques covered in this manual you may want to tackle colored line art images. Keep in mind that color images are seen by the scanner as black and white in 1-bit mode and as grayscale in any other mode. The basic goal of colored line art is to be able to separate out the various colored portions of the image into elements that can be edited individually later in a painting or drawing program.

Color line art technique overview

1) For colored line art where the various colored segments are already separate, such as colored type, you can scan in 1-bit (black and white) mode. The various segments can then be either colored in a painting program, or converted to vectors and edited in a drawing application.

2) For complex overlapping colored line art images, scan in 24-bit (RGB) mode. This will give you three different grayscale versions of your image. Open this RGB image in Photoshop®. Look at the image in the three (RGB) channels to see which channel(s) have the best separation of the image components. Separate the various elements by selecting the best views of the components.

3) The image can now be colored in Photoshop®, or converted to vectors and edited in a drawing application.

GRAYSCALE CONTONE SCANNING

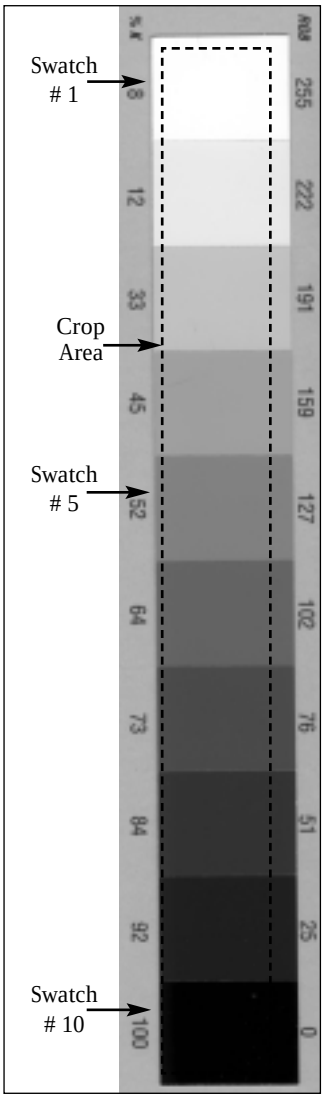


Figure 46 Calibration Target
Use this ten–step grayscale target which comes with your MagicScan manual to linearize your scanner. Note that the RGB values are conveniently listed on the right side. The dashed line is the crop/selection area to be chosen.

When challenged with capturing and reproducing grayscale contone images, our main focus needs to be *grayscale reproduction*. *Linearization* calibration and setting proper *highlight* and *shadow* points are key factors in accurate grayscale value reproduction.

Calibration of your UMAX scanner

Linearization for grayscale scanning

Calibrating your scanner is the first key step to the creation of good quality scanned continuous tone images like photographs. Without calibration you may not receive consistent results from your scanner. There is one fundamental calibration procedure for grayscale images – Linearization.

Clean your scanner bed and place your 10-step UMAX calibration target and your first images squarely side-by-side on the scanner bed.

Simple linearization calibration step-by-step for grayscale images:

1) Under the Settings menu, set the Preview size to “Max. area”. Then Preview the UMAX target in 8-bit mode (gray 256 scales).
2) Select the 10 step grayscale portion of the UMAX target, including the pure white and pure black end swatches. (Be careful to just select the grayscale portion of the target (Fig. 46).
3) Select/crop the editable histogram within the Enhancement tools.
4) Adjustment: Click on the auto button to move the highlight and shadow pointers so that they are at the beginning and the end of the data peaks. This can be confirmed by measuring the grayscale values of the pure white (255) and pure black (0) swatches.
5) Zoom in a bit on the middle portion of the grayscale target so that you have a good view of the middle swatches. Use swatch # 5 (127) to start (counting down from the white swatch).
6) With the built-in intensitometer, Info Window, measure the grayscale value of the #5 swatch. Swatch # 5 will probably register a grayscale value lower (darker) than its actual value of 127.
7) To make a quick overall correction of your scanner’s response to grayscale values, adjust the midpoint of the gamma curve by changing the value in the middle box of the histogram tool, until the Info tool measures the #5 target swatch at ~127. The default

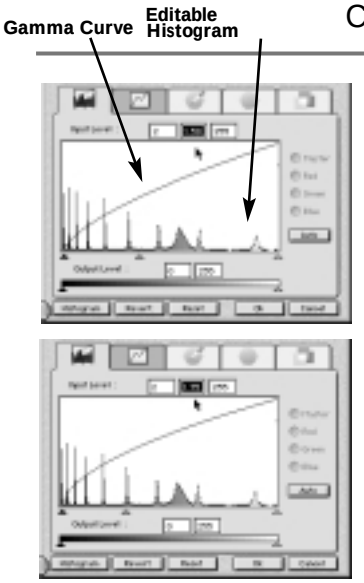


Figure 47 Gamma Curve Linearization

Seen here is MagicScan's editable histogram and gamma curve. The top curve box shows the default settings. The bottom dialog box shows the calibrated settings. Compare the top and bottom boxes for: 1) positions of the highlight and shadow pointers; 2) shapes and positions of the gamma curves, 3) the position of the midpoint and the midpoint numbers (1.5 and 1.75). The calibrated settings are obtained by setting the shadow pointer (far left) and highlight pointer (far right) so that the first (white) and last (black) grayscale swatches measure "255" and "0" respectively. Then adjust the position of the midtone number so that the fifth grayscale swatch measures "127" when measured with the scanner's intensitometer. The midtone gamma curve number will generally be between 1.9 and 2.0 after the adjustment.

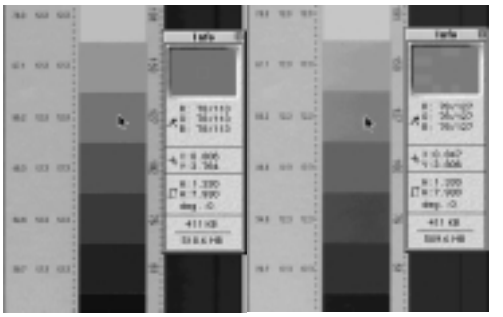


Figure 48 Info Tool

MagicScan's Info tool is used to measure grayscale values on targets and images. Note the starting (113) and ending (127) values before and after gamma curve adjustment.

gamma value in MagicScan is 1.5 on a Mac and 1.0 on a Windows system. Adjust the gamma curve mid-tone value up until the #5 grayscale swatch is 127. Perform this change incrementally, 0.1 per change, and watch how the intensitometer readings gradually increase. You may have to jiggle the intensitometer slightly (move the cursor) after each adjustment to make sure the software registers the change in grayscale value. A typical adjusted midpoint in the gamma curves may be 1.9 –2.0. Note how the curve arches up and the entire image lightens when you make this adjustment. Don't worry if the intensitometer doesn't read exactly 127, or if the value varies slightly (by one or two points) as you move the intensitometer around the swatch.

8) Save the corrected scanner settings as default settings, so that they will automatically be applied to each image scanned. Under the "Settings" menu, set the MagicScan "Preferences" to "Keep current parameter settings". The gamma curve should not be touched again while adjusting individual images or else it will destroy the calibration adjustment we just performed.

9)For best results, this linearization calibration should be performed at the beginning of each scan session, or at least once each week.

Note: Protect your targets. When not in use, we recommend you keep your targets in moisture-proof light-tight containers. Constant exposure to light and humidity will progressively degrade the target, which will then no longer be consistent with its published data values.

This simple linearization adjustment provides you with an easy way to make noticeable improvements in the overall quality and consistency of your scanned images without drowning you in technical details, long procedures, or costly purchases. Remember that once you have set the gamma curve midpoint, do not adjust it when you are scanning individual images, or you will destroy the calibration setup. Any tool which is used for calibration should not be used for any other purpose.

Figure 49 Grayscale Photo

Grayscale Image Scanning

Grayscale photo scanning procedure

Linearize your scanner, as described above, at the beginning of each scan session. Clean your scanner bed and place your grayscale image (Fig 49) squarely on the scan bed.

Note that with the PowerLook 3000 a rubber mat is provided to flatten and stabilize reflective images.

1) Set Manual as your basic control.

2) Set scan mode to 8-bit+ (grayscale) in the scanner control palette.

3) Make sure there is not an "X" in the box before "Auto" in the bottom half of the scanner control window.

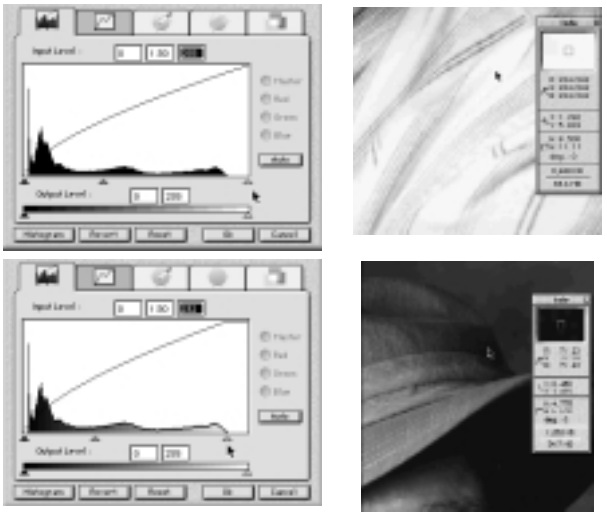


Figure 50 Tone Compression

Use the editable histogram, left above (Image Enhancement tool) to set highlight and shadow points. The highlight and shadow pointer triangles should be placed near the beginning and end of the image data in the histogram as shown above. For even better results, fine tune the placement of these highlight and shadow point slider triangles by using the Info tool, right above, along with the editable histogram. Set the highlight point in the histogram so that the diffuse highlight area (shirt above) in the image reads ~ 242 (5% gray) in the Info tool. Set the shadow point so that the shadow area (hat above) reads ~12-24 (90-95% gray) for standard commercial printing.

4) Preview at low resolution (72ppi). Set the preview resolution in the bottom left side of the preview window.

5) Crop the portion of the image you want to scan using the Selection frame tool. Please crop the image accurately so the corrections you apply are to the image data, not the surrounding data.

6) Activate the editable histogram in the Enhancement tools.

7) To adjust the highlight values on a Macintosh, arrange your Info tool and Editable histogram so they and the white shirt area are all visible. Raise or lower the highlight value by moving the highlight right end of the histogram, until the RGB values in the right hand of the Info tool measures about 242 when placed over the left shirt (see Fig. 50). On a Windows system you will need to make a histogram tool adjustment as described above and then click "OK". Remeasure the image area. If another adjustment is needed, open the histogram tool again and move the curve again.

8) If a diffuse highlight (light detail area like a white shirt) is available in the image

Figure 51 Curve Tool: Lighten
Curve tools are used to adjust image brightness and contrast. Here we are lightening the entire image. Contrast with image in Figure # 42.

Figure 52 Curve Tool: Darken
Curve tools are used to adjust image brightness and contrast. Here we are darkening the entire image. Contrast with image in Figure # 42.

Figure 53 Curve Tool: Increase Contrast
Curve tools can also be used to adjust image contrast. Here we are increasing contrast across the entire image. Contrast with original image in Figure # 42.

Figure 54 Curve Tool: Decrease Contrast
Here we are decreasing contrast across the entire image by flattening the curve in the midtones. Contrast with original image in Figure # 42.

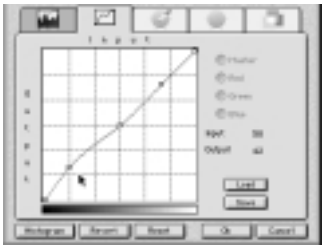


Figure 55 Curve Tool: Selective Lightening
Curve tools can also be used to adjust specific portions of images. Here we are lightening just the midtone to shadow area of the image.

area, measure this highlight area with the Info tool. Next, adjust the position of the highlight slider in the editable histogram, to be sure that the highlight values do not exceed the highlight reproducibility limit of your printing device. A typical value for a standard commercial press as well as many desktop printers is 5% gray (242 in the Info tool). If you are printing in-house and are unsure of your printer's highlight values please check with the manufacturer, or you can determine it yourself by experimentation.

9) If the highlight value is too high or light(≤5% or ≥242) move the highlight tab to the right until the intensitometer measurements in the diffuse highlight area are ~242. This will prevent your images from"blowing out" in the highlight areas. If the highlight values are too dark (≥5% ≤242) then move the highlight slider to the left until the highlight areas measure ~242.

10) Shadow point adjustments can be similarly made. Here we will adjust the left (shadow) slider until the shadow area measures ~95% or 12 in the Info tool.

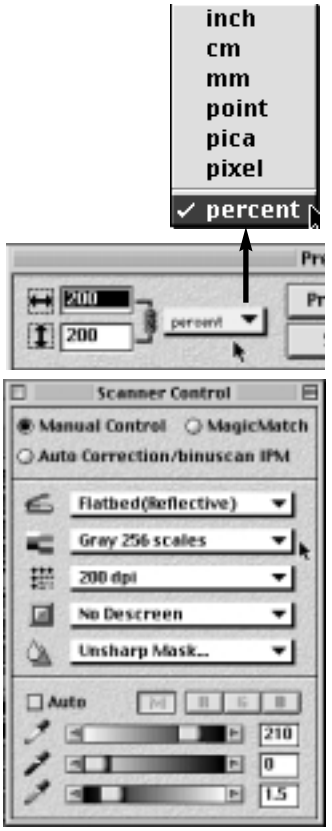


Figure 56 Resolution and Scaling Setup

MagicScan's scaling controls are found in the upper left-hand corner of the Preview window (top). Units can be chosen to suit your needs. Assign the final resolution you would like your image to have, here 200ppi (bottom) and the scaling which you would like the scanner to perform, here 200%, and the scanner will do the rest. MagicScan will direct the scanner to scan at 400ppi, and resize the image 200%. This resizing will lower the image resolution to the requested 200ppi.

Output levels, the twin slider bar at the bottom of the editable histogram tool, can be used to set maximum shadow values and minimum highlight values to specific values. For instance if you didn't want any highlight value to go below 5% (242) gray nor any shadow value to go above 95% (18) then the highlight and shadow slider values in the output levels dialog box can be set at these values. Then, no matter what values the scanner may capture, the final image will have maximum and minimum grayscale values of 95% and 5% respectively.

11) Use the Curve tool to adjust overall brightness and contrast of an image. To lighten or darken: Move the midpoint of the curve up or down (see Figs. 51 and 52). To adjust the contrast, flatten the curve where you want grayscale values to be concentrated. Flatten curve near the highlight and shadow ends of the curve to increase overall image contrast (see Fig. 53). Flatten curve in the midtone area to lower overall image contrast (see Fig. 54). Specific sections of the grayscale spectrum of an image, such as the shadow areas, can be lightened or darkened by raising or lowering specific sections of the curve (see Fig. 55).

12) Set resolution to 200ppi – 300ppi depending upon the line screen at which you intend to print. See the section on Contone Scanning Resolutions at the end of Chapter III for more information on setting scanning resolution for contone images (Fig. 56).

13) Set scaling percentage to match your output needs using the Scaling tools in the upper left-hand corner of the image Preview window. Be sure that the horizontal and vertical scaling are the same so that you do not apply any distortion to your image. You should have the scanner perform the scaling whenever possible, rather than perform this scaling in the post-scan in Photoshop®, or other pixel-based imaging software. Your scanner will perform the scaling faster and do a better job (Fig. 56).

Note: Your scanning resolution will automatically increase to accommodate any scaling percentage you assign. For example, if you assign the scanner to perform a 200% scaling, then the resolution of the scanner will automatically increase by 200%. This increase in scanning resolution will not appear in your scanner control window however; it occurs automatically in the background. The resolution you set in the scanner control window will determine the final resolution of your image at the end of the scan. For more information on the relationship between scanning resolution and scaling see the sections on resolution and scaling in Chapter I of this manual (Scanning Concepts), and in the Contone Scanning Resolutions section at the end of Chapter III.

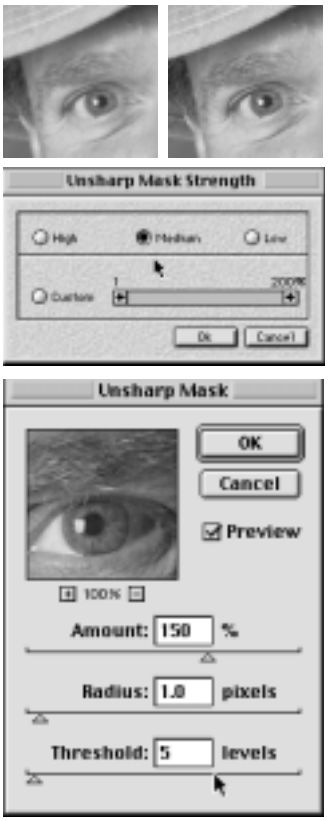


Figure 57 Image Sharpness
On the left is a portion of an image which has been scanned properly but not sharpened. On the right is the same scanned image, with sharpening applied. Note how the high contrast portions of the right image, such as the eyes, eye brows, and hat fabric are sharper and are in better focus. This sharpening can be applied either during the scan (top) or in the post-scan in Photoshop® (middle). Note the Threshold value set at 5 to protect the facial skin areas from too much sharpening.

14) Double click on the thumbnail image in the Scan Job List window to set the image to be saved as a pixel-based TIFF. A TIFF (.tif) is a pixel-based file format which works equally well on both Mac and Windows platforms.

15) Sharpening is the final step to capturing and correcting an image. All scanners soften images during the scanning process. To improve image sharpness we use a tool called *unsharp mask*. This sharpening can be applied during the scan or, if you prefer, you may use the unsharp mask tool in Photoshop® to apply unsharp mask and improve image focus.

16a) To apply unsharp mask during the scan with MagicScan software, click on the "Filter" menu in the Scan Control palette. Select "Unsharp mask" at the bottom of the menu. Try the medium and High choices (see Fig. 57) and see which one gives you the best results for your images.

16b) For a bit more control over your unsharp masking, you can apply unsharp mask through Photoshop® after you have scanned your image. Here are some starting values for a 200ppi grayscale portrait image opened in Photoshop®: Unsharp mask Amount = 100-150, Radius = 1–2, Threshold = 3-6 (see Fig. 57). Unsharp masking may be performed during the scanning process. If you know that you will be combining this image with another and/or performing significant image editing, it is generally best to wait until these chores are finished before applying unsharp mask.

17) Scan image at this higher resolution and with the proper scaling set for the second and final scan.

18) Your scanned image can now be opened and edited in any pixel-based imaged editing software, such as Photoshop. If you have used the UMAX Plug-in or TWAIN module to acquire your scanner through your image editing software, your image may already be open and available for editing.

Poor Quality Image Note:

Proper setting of highlight and shadow points, using editable histograms, is a first step to helping to improve poor quality images. Significant adjustments of an image's brightness and contrast, using a curve tool, may be required to correct images which have initial lightness and contrast problems. Some images require mostly global changes; others may need only specific area adjustments, such as lightening shadow regions, while some others will require both. Nearly all scanned images require the use of unsharp masking to improve their sharpness or focus.

COLOR CONTONE SCANNING (REFLECTIVE)

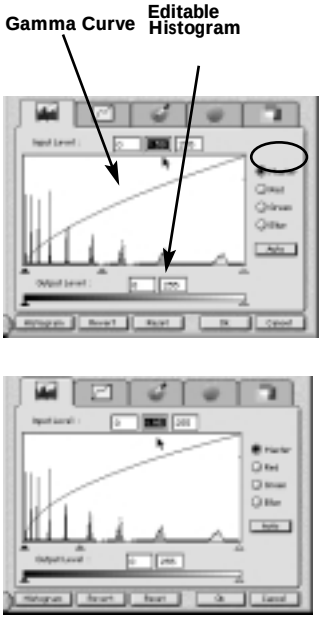


Figure 58 Gamma Curve Linearization

Seen here is MagicScan's editable histogram and gamma curve. The top curve box shows the default settings. The bottom dialog box shows the calibrated settings. Compare the top and bottom boxes for 1) the shapes and positions of the gamma curves, 2) the position of the midpoint and the midpoint numbers. Note that the calibrated curve has a higher midtone value, (1.95 vs 1.5)), and a higher arched curve than the uncalibrated curve, resulting in brighter images with better shadow detail. Note that the calibration is performed with the Master Channel selected.

When we are challenged with capturing and reproducing color contone images, our main focus, as with grayscale contone images, needs to be *Grayscale Reproduction*. *Linearization* and *neutralization* calibration and setting proper highlight and shadow points are key factors in helping us reproduce grayscale, and therefore color values accurately.

Calibration of your UMAX scanner

Linearization and neutralization for color scanning

Calibrating your scanner is the first key step to the creation of good quality scanned continuous tone color images like photographs. Without calibration you may not receive consistent results from your scanner. There are two related fundamental calibration procedures for color images, *linearization* and *neutralization*. This calibration will help us control the brightness and contrast, and remove any unwanted color cast from our color images.

There are two kinds of color cast: Scanner and Image. Scanner color cast may be created when a scanner shows unequal sensitivity to red, green or blue light. Image color cast can be created in many ways, including lighting conditions, film emulsion bias, or exposure problems. These two sources of calibration should be isolated and treated separately. The following is used for the isolation and removal of Instrument (scanner) color cast. Any color cast remaining after the scanner color cast has been removed will belong to the image. Clean your scanner bed and place images squarely on scan bed.

We will perform the linearization similar to the one described for grayscale contone calibration, with the only difference being scanning in 24-bit mode (True Color RGB mode).

Simple linearization calibration step-by-step for color images

1) Under the Settings menu, set the preview size to "Max. area." Then Preview the UMAX target in 24-bit mode (True Color RGB).

2) Select the 10-step grayscale portion of the UMAX target, including the pure white and pure black end swatches. (Be careful to select only the grayscale portion of the target.)

Before Calibration Linearized Neutralized

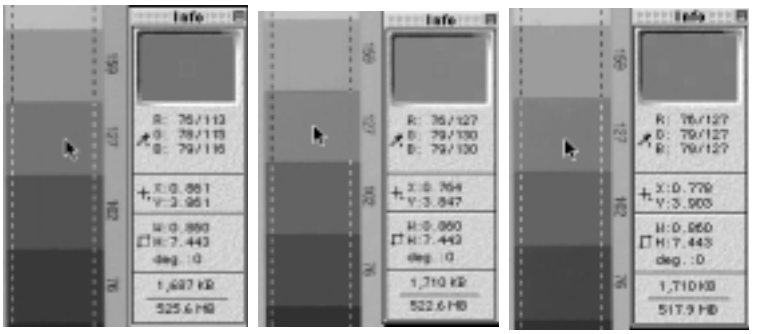


Figure 59 Info Tool

MagicScan's Info tool is used to measure grayscale values on targets and images. The starting RGB values are 113, 115, and 116 before any calibration is performed. After initial linearization the RGB values are 127, 130, 130. After final color cast removal, neutralization, with the color cast adjustment tool (Figure 50) the values are all equal (RGB = 127,127,127). The scanner is now linear and neutral.

3) Select the editable histogram within the manual tools. Be sure the master channel is selected (see Fig. 58).

4) Click on the auto button to move the highlight and shadow pointers so that they are at the beginning and the end of the data peaks. You can confirm this by measuring the grayscale values of the pure white (255) and pure black (0) swatches.

5) Zoom in on the middle portion of the grayscale target so that you have a good view of the middle swatches. Start with swatch # 5, counting down from the white swatch.

6) Now with the Info tool (Fig. 59) measure the grayscale value of the #5 target swatch. Swatch # 5 may register a grayscale value in the 115 range. Its grayscale value should be at 127 (seen at the right of the target).

7) To make a quick overall correction of your scanner's response to grayscale values, adjust the midpoint of the gamma curve by changing the value in the middle box of the histogram tool until at least one of the RGB values in the Info tool measures the ~127 for the #5 target swatch. The default gamma value in MagicScan is 1.5 on a Mac and 1.0 on a Windows system. Adjust the gamma curve mid-tone value up until the #5 grayscale swatch is 127. Perform this change incrementally, 0.1 per change, and watch how the intensitometer readings gradually increase. You may have to jiggle the intensitometer slightly (move the cursor) after each adjustment to make sure the software registers the change in grayscale value. A typical adjusted mid-point in the gamma curves may be 1.7 –2.0. Note how the curve arches up and the entire image lightens when you make this adjustment. Don't worry if the intensitometer doesn't read exactly 127, or if the value varies slightly (by one or two points) as you move the intensitometer around the swatch. Remember that a one-unit movement only represents a 0.4% change.

Figure 60 Color Adjustment Tool for Neutralization

A color cast adjustment tool, such as this one in the Enhancement tools, allow you to adjust the Red, Green and Blue response of the scanner separately in the highlight, midtone and shadow regions. These numbers are adjusted so that the scanner will capture neutral grayscale areas with equal RGB values when measured with the scanner's intensitometer.

Here the Green and Blue values are adjusted down -5 so that they match the Red value. See the change in the Info palette from the linearized to neutralized portions in Figure 50 to see the results of these adjustments.

Neutralization for Color Images

1) Once the overall gamma curve has been set as described above, you may notice that the RGB values are not equal. This means that the scanner is not neutral; that is, it will create a color cast in any image it captures. The greater the disparity in their RGB values, the greater will be the color cast imposed by the scanner.

2) We want to adjust the RGB values so they are all are equal when measuring the grayscale portions of the target with the intensitometer. To accomplish this we will use the color cast correction tool in the manual controls.

3) Activate the color cast correction tool (see Fig. 60). Select the midtone button. Adjust the midtone Red, Green, and Blue values up and down until all three values are equal to 127.

4) Save the corrected scanner settings as default settings, so that they will automatically be applied to each image scanned. Under the "Settings" menu, set the MagicScan "Preferences" to "Keep current parameter settings." This color cast correction tool should not be used again while adjusting individual images or else it will destroy the calibration we just performed. We will use other tools to adjust the color in individual images.

5) For best results, this linearization and neutralization calibration should be performed at the beginning of each scan session.

Note: Protect your targets. When not in use, keep your targets in moisture-proof light-tight containers. Constant exposure to light and humidity will progressively degrade the target, which will then no longer be consistent with its published data sheet values.

These affordable, simple, linearization and neutralization adjustments are intended to provide you with an easy way to make noticeable improvements in the overall quality and consistency of your scanned images without drowning you in technical details, long procedures or costly purchases. More detailed, fine tuning adjustments can be accomplished by measuring, comparing and adjusting additional grayscale swatches in other sections of the grayscale spectrum or through the purchase and use of color management software.

Linearize and neutralize your scanner, as described above, at the beginning of each scan session.

Some calibration tips

1) Use only targets which have known grayscale and/or RGB values associated with them such as the UMAX target provided with this manual.

2) When linearizing and neutralizing a scanner, measure and correct at least three swatches of the grayscale spectrum, preferably near the highlight, mid-tone and shadow regions of the spectrum.

3) Use a separate tool for calibration (linearization–gamma curve and neutralization–color cast adjustment tool) which you do not adjust after you linearize and/or neutralize the scanner. This way you will only need to calibrate the scanner once for the entire scan session. Any other image adjustments that need to be made on any image should be performed with a different tool, such as editable histograms and curves.

4) To save time on color contone scans, a combined linearization/neutralization calibration can be performed at the beginning of each scan session. Note: As mentioned above, you should use separate tools for calibration of the scanner and then use other tools to adjust individual images.

5) It is usually better to linearize and neutralize a scanner than to wait to make these corrections in the post scan in Photoshop®.

6) Calibration settings can be saved either as default settings, so that they will automatically be applied to each image scanned, or as separate data files which can be loaded and used whenever you choose.

Figure 61 Original Color Photo
Bordered number areas are reference areas in text.

Color image scanning

Color photo scan procedure

Clean your scanner bed and complete the linearization and neutralization described above using the calibration target provided. Place your first color contone image squarely on scan bed.

Note: The PowerLook 3000 rubber mat is provided to flatten and stabilize reflective images.

Before Correction ***After Correction***

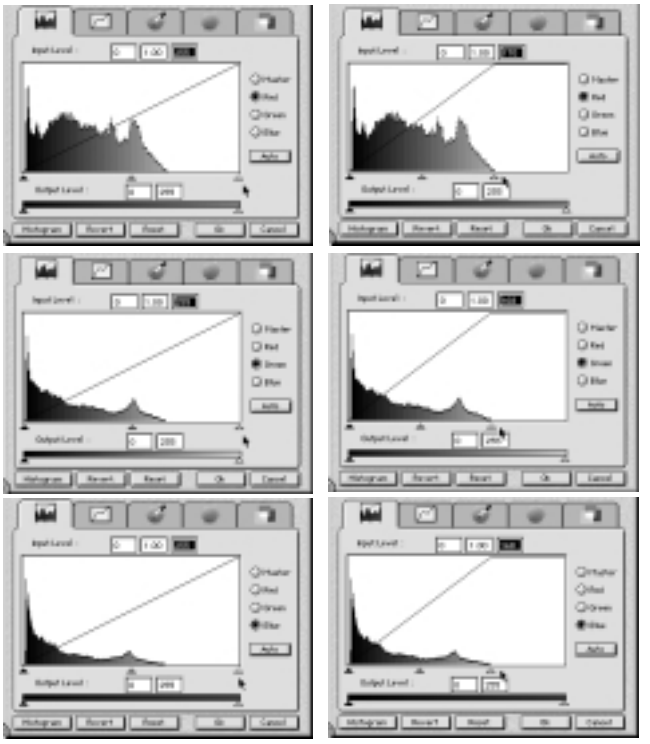


Figure 62 Setting Tone Compression
Setting highlight and shadow points should be performed on individual channels, as shown above, rather than on the Master Channel. As a starting point set the highlight and shadow points visually by placing the highlight and shadow pointers at the beginning and the end of the image data in the histogram. These highlight and shadow points can be fine tuned using the Info palette either here in the histogram or later with the curves tool. *(See pg. 80 for color versions of Figures 61 and 62.)*

1) Set basic control to Manual.

2) Set scan mode to 24-bit+ (RGB color). Note that RGB and CIELab conversion modes are only available when MagicMatch scanning is selected. See the section on automated Color Matching & Correction later in Chapter III for more information on automatic scanning.

3) Make sure there is not an “X” in the box before “Auto” in the bottom of the Scanner Control window.

4) Preview scan at low resolution (72ppi). Set this in the bottom left corner of the Preview Image window.

5) Crop the portion of the image you want to scan using the Selection Frame tool in the Preview Image window. Please crop the image accurately so that the corrections you apply are on the image data, not the surrounding data.

6) Activate the editable histogram from the Image Enhancement tool window. Select the Red channel.

7) To approximately set the highlight and shadow points of your image, move the highlight and shadow tabs (the left and right tabs below the histogram) so that the two pointers are at the beginning and the end of the image

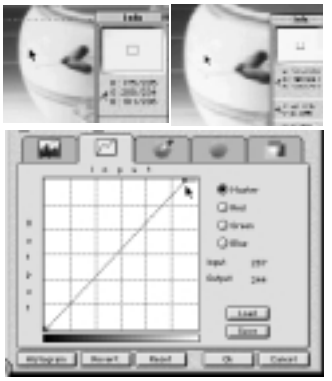


Figure 63 Highlight Adjustment
Here we are raising the highlight value using the Curve on the Master channel. This will raise all three (RGB) values simultaneously. Adjust the position of the highlight end of the Curve until all the right side RGB values of the Info tool ~242 (right).

data as seen in the histogram. IMPORTANT: Perform this tone compression (setting highlight and shadow points) separately on each (Red, Green, and Blue) channel. Do not perform this on a master channel or use the "Auto" button (Fig. 62). We will fine tune these values during the neutralization in the next step.

Neutralization: Color cast removal

We will neutralize this image by measuring and adjusting two areas of the image, the white milk in the top of the pitcher (location 3), and the white tile in the lower left hand corner (location 6). Neutralization of the image, to remove unwanted color cast, and fine tuning of the highlight and shadow values can now be performed. Identify one or more areas of the image which should be neutral (an area such as a white highlight is often appropriate for both neutralization and fine tuning highlight values). There are several neutral areas in this photo which can be used for color cast determination and adjustment. We will measure several neutral areas including the milk in the pitcher, the rim of the white ceramic bowl, the white plastic cover of the Kitchen Whiz computer, and a couple of areas in the white tiles.

We will use the Curve tool to make adjustments to the color values which the scanner will record. In some cases, such as when we fine tune the overall highlight value, we will adjust the curve on the Master channel which will adjust the Red, Green and Blue values simultaneously. When we are removing color cast we will adjust curves for individual RGB channels. Making Curve tool adjustments involves clicking at various places on a curve and then moving the curve up or down to either increase or decrease the value of the selected color in a specific portion of the tonal range, such as the quartertone or midtone of the image.

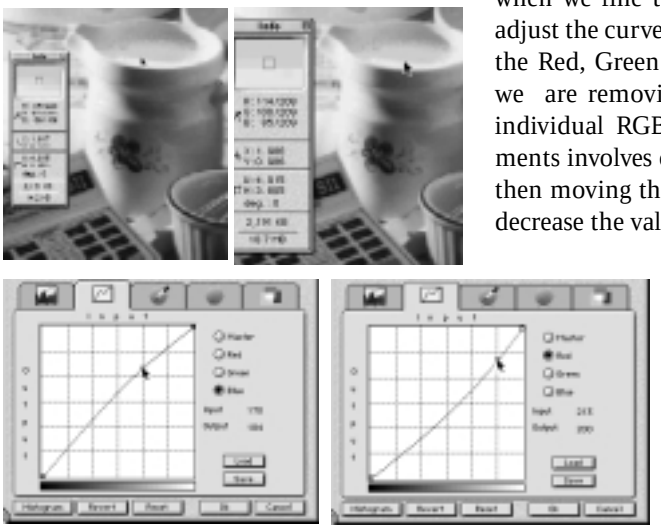


Figure 64 Neutralization of Quatertone
Here we are raising the highlight value using the Curve on the Master channel. This will raise all three (RGB) values simultaneously. Adjust the position of the highlight end of the Curve until the right side RGB values of the Info tool ~242.
(See pg. 81 for color versions of Figures 63 and 64.)

Neutralizing and fine tuning highlight values:

8a) There are two highlights in this image, a specular highlight, which is a white image area which has no detail, and a diffuse highlight, which is a white image area which does have some detail. The specular highlight area is the bright white area of the white tiles on the left side of the image,

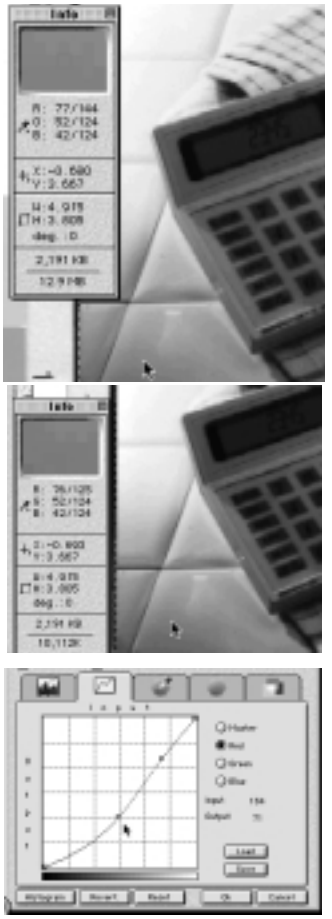


Figure 65 Midtone Neutralization
Here we are measuring and adjusting a neutral area in the midtone region of the image. In the top, uncorrected image, the histogram shows a high Red value of 144 compared with the 124 for the Green and Blue values. To correct this excess of Red we activate the Red curve, and lower the curve in the midtone until the Red value ~ 124. The second, corrected image shows all three, R,G,B values = 124. *(See pg. 82 for color version of Figure 65.)*

(see location [1]). The diffuse highlight area is the white area on the left side rim of the white ceramic bowl (see location [2]). When adjusting the RGB values in a white diffuse highlight area of an image, we adjust the diffuse highlight values so that they are appropriate values for printing that highlight. As mentioned in the grayscale section a typical highlight for a commercial press as well as many desktop printers is 5% (0-100) or 242 (0-255). So a typical RGB measurement for a white highlight in a color image would be 242, 242, 242 or 5,5,5 (depending upon the grayscale measurement units used by your scanner). If you are printing in-house and are unsure of your printer's highlight values, please check with the manufacturer, or you can determine it yourself by experimentation.

8b) Quartertone neutralization: With the Info tool measure the RGB values of the milk in the pitcher. The Info tool will show unequal RGB values R=223, G=209, B=189 (Fig. 64 upper left). Note that your values may vary slightly. The overall presence of this red color cast can be confirmed by measuring other neutral areas such as locations [4] [5] and [6]. To correct this imbalance activate the Curve tool (Enhancement tools). We will lower the Red values and raise the Blue values until all three equal ~209, or whatever your green value is. Activate the Red channel. Now drag the upper end of the Red curve down until the Red value in the milk equals 209. Now activate the blue curve. Drag the upper end of the Blue curve up until the Blue value in the milk equals 209 (Fig. 64, bottom).

When your adjustments are completed your Info tool should indicate that all three right hand values (RGB) are equal (Fig. 64, upper right).

8c) Midtone neutralization: With the Info tool measure the RGB values of the tile in the lower left-hand corner of the image. The Info tool will show an elevated Red reading, R=244, G=124, B=124 (Fig. 55, upper left). Note that your values may vary slightly. To correct this elevated Red reading activate the Curve tool (Enhancement tools). We will lower the Red value until all three equal ~ 124. Activate the Red channel. Now drag the middle part of the Red curve down until the Red value in the milk equals ~124 (Fig. 65 bottom).

When your adjustments are completed your Info tool should indicate that all three values (RGB) are equal (Fig. 64, middle).

Note: We have performed neutralization on the quartertone and midtone portions of this image. Neutralization can be performed on any portion of an image which contains neutral areas, including

highlight, three-quartertone and shadow portions of images, using the same techniques we have used here.

You may use the Curve tool to adjust overall brightness and contrast of the image using the Master Curve (which controls all three channels simultaneously). To lighten or darken: Move curve up or down. To adjust contrast: Flatten the curve where you want grayscale values. Flatten curve in the midtone area to lower overall image contrast. Refer to Figs. 51 and 52. Flatten curve near the highlight and shadow areas to increase overall image contrast. Specific sections of the grayscale spectrum of an image, such as the shadow areas, can be lightened or darkened by raising specific sections of the master curve. See Figs. 51-55 for instructions on controlling image brightness and contrast.

9) Set resolution to 200ppi – 300ppi depending upon the line screen at which you intend to print (Fig. 67). See the section on Contone Scanning Resolutions at the end of this chapter for more information on setting scanning resolution for contone images.

10) Set scaling percentage to match your output needs using the Scaling tools in the upper left-hand corner of the image Preview window. Be sure that the horizontal and vertical scaling are the same so that you do not apply any distortion to your image. You should have the scanner perform the scaling whenever possible, rather than perform this scaling in the post-scan in Photoshop® or other pixel-based imaging software. Your scanner will perform the scaling faster and do a better job (Fig. 67).

Note: Your scanning resolution will automatically increase to accommodate any scaling percentage you assign. For example, if you assign the scanner to perform a 200% scaling, then the resolution of the scanner will automatically increase by 200%. This increase in scanning resolution will not appear in your scanner control window, however; it occurs automatically in the background. The resolution you set in the scanner control window will determine the final resolution of your image at the end of the scan. For more information on the relationship between scanning resolution and scaling see the sections on resolution and scaling in Chapter I of this manual (Scanning Concepts), and in the Contone Scanning Resolutions section at the end of this chapter.

11) Double click on the thumbnail image in the Scan Job List window to set your image to be saved as a pixel-based TIFF or EPS (See section on file formats at the end of Chapter I).

12) The final step to capturing and correcting an image is sharpening. All scanners soften images during the scanning process. To

Figure 66 Raw and Final Images
The top image was the image created with a Raw scan, without corrections. The bottom image is the result of the tone compression, color correction and unsharp mask performed in this chapter. Note how the top image has a distinct red color cast, and is darker and lower contrast and appears to be out of focus when compared with the lower, adjusted image. Compare your final image with the results seen here. Remember that an accurate printed version of your RGB scan will depend upon a correct RGB to CMYK conversion. *(See pg. 82 for color version of Figure 66.)*

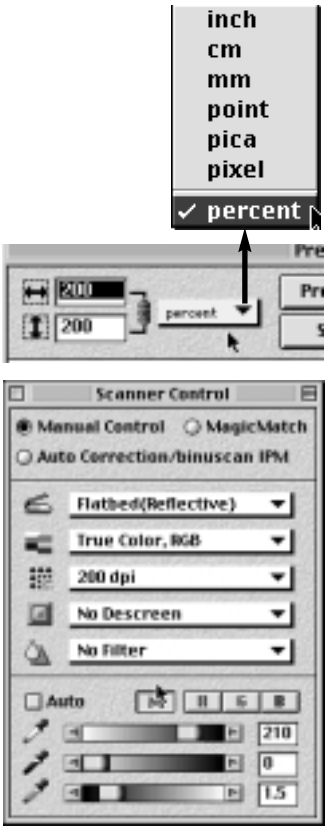


Figure 67 Resolution and Scaling Setup

MagicScan's scaling controls are found in the upper left hand corner of the Preview window (top). Units can be chosen to suit your needs. Assign the final resolution you would like your image to have, here 200ppi (bottom), and the scaling which you would like the scanner to perform, here 200%, and the scanner will do the rest. MagicScan will direct the scanner to scan at 400ppi, and resize the image 200%. This resizing will lower the image resolution to the requested 200ppi.

Figure 68 Unsharp Mask

If you decide to apply unsharp mask during the scanning process, you can use MagicScan's unsharp mask dialog box to adjust the amount of unsharp mask which will be applied. Use medium as a starting point, then try high and compare the results. For post-scan control of unsharp mask try Photoshop's® unsharp mask filter.

improve image sharpness we use a tool called unsharp mask. This sharpening can be applied during the scan or, if you prefer, you may use the unsharp mask tool in Photoshop® to apply unsharp mask to improve image focus.

13a) To apply unsharp mask during the scan with MagicScan software click on the "Filter" menu in the Scan Control palette. Select "Unsharp mask" at the bottom of the menu. Try the medium and High choices (Fig. 68) and see which one gives you the best results for your images.

13b) For a bit more control over your unsharp masking, you can apply unsharp mask through Photoshop® after you have scanned your image. Here are some starting values for a 200ppi grayscale portrait image opened in Photoshop®: Unsharp mask Amount = 100-150, Radius = 1–2, Threshold = 3-6 (Fig. 57). Unsharp masking may be applied either during the scanning, or after the scan in an application like Photoshop®. If you know that you will be combining this image with another and/or performing significant image editing, it is generally best to wait until these chores are finished before applying unsharp mask.

After each application of Unsharp Mask in Photoshop®, follow with a Fade Unsharp Mask (Filter – Fade – 100% Luminosity) to prevent color shifts along high contrast edges.

Note: Color shift problems along high contrast edges can be avoided by: 1) performing unsharp mask on individual lower contrast channels, 2) performing unsharp mask on "L" channel in Lab mode, or 3) Fading unsharp mask to 100% Luminosity in Photoshop® Filter menu as described in the previous paragraph.

14) Scan image at this higher resolution for the second /final scan.

15) After the scan is complete, open the image in an image-editing application such as Photoshop®. (If you did not apply unsharp mask during the scan, apply unsharp mask as described in 13b.)

RGB – CMYK Note:

All scanners capture their images in RGB mode. Some scanners can convert your image to another color space, such as CMYK, on the fly. If you are planning to print your image on a CMYK printing device your images must be converted into CMYK. The question is when and where should this conversion occur? If you are sending your files out to have them printed at a service bureau or printing company, ask them for instructions as to who should perform the conversion, and how it should be done. If you are printing to your own in-house color printing device you will need to first determine what kind of file your printing device accepts. Some accept RGB, and some only CMYK. If your color printer only accepts CMYK you can have your UMAX scanning software perform the conversion for you by using the MagicMatch or binuscan PhotoPerfect software, (see the Automated Color Matching and Correction section later on in this chapter) or you can perform the conversion in an image-editing application like Adobe Photoshop®.

Poor Quality Image Note:

Proper setting of highlight and shadow points, using editable histograms, is a first step to helping to improve poor quality images. Significant adjustments of an image's brightness and contrast, using a curve tool, may be required to correct images which have initial lightness and contrast problems. Some images require mostly global changes; others may need only specific area adjustments, such as lightening shadow regions, while some others will require both. Nearly all scanned images require the use of unsharp masking to improve their sharpness or focus.

TRANSPARENCY SCANNING (POSITIVES)

Figure 69 Frame Holder
Shown here is the frame holder for a 2¼"x 2¾" transparency. The double pattern of the three dots at the top and bottom of the frame is used for the auto recognition.

Figure 70 Film Support Choices
In MagicScan you have the choice of three types of frames: 1) 35mm slide tray for multiple slides, 2) frame holders of various sizes, and 3) a negative holder (PowerLook 3000 only).

Calibration of your UMAX scanner

Linearization and/or neutralization for grayscale or color scanning

The same calibration techniques discussed for scanning grayscale and color reflective images earlier in this chapter apply to scanning transparencies as well. The only difference is that a transparent target with known grayscale values should be used. Separate transparent targets (positive and negative) are needed because a different, overhead, light source will be used, and that light will be transmitted through, rather than reflected off, the target and images to be scanned.

Handling transparencies

It is a good idea to always handle your transparencies with white, lint free gloves. It is very easy to get fingerprints on transparencies. They are easily damaged, particularly on the emulsion side.

Using one of several film holders provided with your UMAX scanner makes handling of your transparencies easier. Besides, this easier and cleaner handling, the MagicScan software also provides an auto-detect feature which will automatically locate images placed inside the provided film holders. MagicScan provides three choices: 1) *35mm slide tray* for mounted slides, 2) *Frame holder* for unmounted film placed in your custom UMAX frame holders, and 3) *Negative film holder* for use with strips of film scanned on the PowerLook 3000. Note: Your scanner is shipped with one or more of the following four frame holders: 4”x 5,” 2¼" x 2¾" (6cm x 7cm), 2¼" x 2¼: (6cm x 6cm), and/or a holder for negative strips of film (for use with the PowerLook 3000 only).

Setting up to scan a transparency

1) Clean both the upper and lower scanner glass beds (only lower on the PowerLook 3000) by wiping the glass with a lint-free cloth (provided with PowerLook 3000) which has been lightly sprayed with a mild cleaner such as Windex.

2) Place the transparency image squarely in a transparency holder.

3) Clean your transparency by blowing off the image with canned air.

Figure 71 Scan Control for PowerLook 3000

The PowerLook 3000 supports a high optical resolution of 3048 x 3048ppi which can be used for high-quality scaling of small images like 35mm slides. Having the scanner perform the scaling will result in higher quality images.

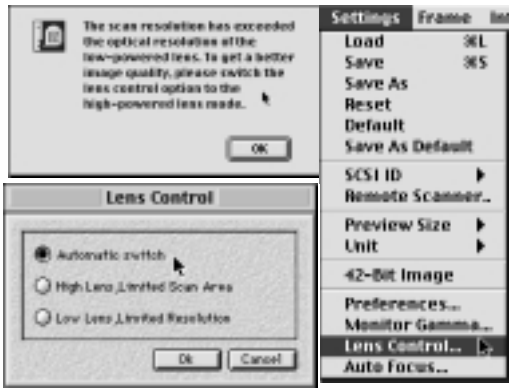


Figure 72 PowerLook 3000 Dual Lens System

The PowerLook 3000 has a dual lens system with both low and high resolution (1220ppi and 3048ppi). If you get this message be sure to check "Lens Control" (Settings menu) to activate the Automatic switch.

4) Place the transparency holder with included image on the scan bed. Note: To take advantage of the maximum optical resolution (3048 X 3048) of the the PowerLook 3000, place the frame holder so that the image is placed inside of the area marked by the 3000dpi line on the scan bed. When using a negative holder, place the metal cover on top of the holder to flatten the negatives securely during the scan.

5) If you are using a PowerLook 3000, check the Preferences settings underneath the MagicScan File menu to make sure that the high resolution lens is set to "Auto." Then you can take advantage of its higher optical resolution capabilities.

6) Close the scanner cover.

7) Launch the MagicScan software.

8) Select the appropriate source image choice (frame holder or tray if you are using one) from the source image menu (Fig. 70).

9) Perform the Calibration and image setup steps discussed in the Color Contone Scanning section of this manual, starting on page 34.

Scaling Transparencies

In many cases when we scan transparencies, and in particular if we are scanning 35mm slides and 120 size film, we need to significantly scale our images to adjust them to a useful print size. For instance scaling a 35 mm slide up to print at 11" x 14" requires a 10x increase size and therefore resolution. This scaling often requires high optical resolution in order to maintain image quality after the scaling. The scaling can be done either during the scan or after the scan. By far the best approach is to have the scanner perform the scaling, as the scanner will perform the scaling faster and with better quality. If you do not have your scanner perform the scaling, you will need to scan your image at a high enough resolution to accommodate the scaling of your images in an image-editing application such as Photoshop®. For instance, if you scan a 35mm slide at 300ppi, but you intend to scale the image after the scan by a factor of ten (10) you would need to scan your original image at 3000ppi to accommodate the post scan scaling without decreasing the resolution and therefore the quality of the image (Fig. 71). Your scanner will perform this scaling by setting the resolution at 300ppi and scaling at 1000%. See the sections on Image Resolution and Scaling in Chapter II, and Contone Scanning Resolution later in this chapter for more information on scaling during the scan.

TRANSPARENCY SCANNING (NEGATIVES)

Figure 73 Negative Emulsion Choices
If the manufacturer of your negative emulsion is listed, select the negative emulsion which matches your film.

Setup specifics for negative scanning

Negative scanning is performed the same way as positive transparency scans, but with a few setup details specific to negative images.

1) Be especially careful when cleaning your negative images, as their emulsion (image) side is particularly susceptible to scratching.
2) Mount your negative images in the frame holder as you would with a positive transparency, but when using the negative strip holder (available with the PowerLook 3000), place the metal mat on top of the strip holder to help keep your negative strips, which tend to curl, flat during the scanning process.
3) When selecting your source image in the scanner control palette, be sure to choose a basic film/emulsion type of the negative images you are scanning from the negative sub menu (Fig. 73).

TRANSPARENCY PROBLEMS

Figure 74 Newton Ring
Newton ring circles can be caused by the bending and separation of light which occurs when light passes through the glass/air/image boundaries.

Dirty transparencies

The most common problems found with scanned transparencies are dirty images which can be prevented by carefully cleaning your scan bed(s) with a lint-free cloth, and cleaning your images with canned air prior to scanning.

Newton rings

An annoying problem sometimes encountered with scanning transparencies is the occurrence of circular patterns of light known as Newton rings (Fig 74). Newton rings are caused by the bending and separation of light as it moves though the glass/air/image boundaries.

1) If this problem occurs intermittently, it may be prevented by simply remounting the image in its holder.
2) If this problem occurs consistently, you should evaluate your scanning environment. A consistently cool, dry area is best. You can find out more information on anti-newton ring products, such as film mounting oil, from your local photography shop.

PREVIOUSLY PRINTED/SCREENED IMAGES

Figure 75 Previously Printed Image

The challenge is to remove the scan pattern created by the printed pattern of halftone dots without softening the image so much that its quality is destroyed.

Figure 76 Descreen Filter

When scanning previously printed images, activate the Descreen Filter in the Scan Control palette to help with the removal of the scan pattern which often results from the scanning of printed materials. Configure MagicScan's descreen filter to match the line screen at which the image was printed.

Challenge overview

Printed photographic images, such as an image from a magazine, are constructed from patterns of halftone dots. When scanned, this pattern of halftone dots is captured by the scanner. If this pattern is not removed prior to reprinting, a moiré pattern will likely result (Fig 75).

Our challenge is to convert this scan pattern of high-contrast halftone dots into a lower contrast, smoother pattern of grayscale pixels.So we need to convert dots into pixels and lower the small-scale contrast to remove the original pattern. It is important to remove this halftone dot pattern so that it will not be reproduced as a moiré pattern when it is reprinted after it is scanned.

During the scan

Various tools which can be used individually or together:

A) Place 1/16" sheet of plate glass on scan bed beneath image. (Do not use this method on the PowerLook 3000.)

B) Select the proper scan source/mode, 256 grayscale, or TrueColor RGB, and set up the scan as you normally would for grayscale or color contone images as outlined in previous sections.

C) Rotate image on scan bed.

D) Scan at higher resolution (1.5x) than will be needed to print or reproduce the image.

E) Activate the descreen filter from the Scan Control palette and select the line screen (lpi) at which the image was printed, 85lpi, 133lpi, 150lpi, etc. (Fig. 76).

After the scan in an image-editing application

A) View image in various channels (for color images) to see where most of the patterns are being generated and plan to work on the individual channels.

B) Sample image down to proper resolution.

C) Rotate image to proper position.

D) Apply Noise Filters: Median, De-speckle, or Dust & Scratches to individual channels for color images as needed (Fig. 77).

Figure 77 Photoshop Noise Filter

On difficult images, descreening can be aided through the careful application of noise filters, such as the Median filter, in Photoshop®. Work on individual channels rather than the composite image when descreening color images. This reduces the amount of total damage to an image, thereby preserving as much of the image the quality as possible.

E) Blur individual channels.

F) Apply noise and blur to entire image if necessary (avoid this in color images whenever possible).

G) Convert image to Lab mode.

H) Apply unsharp mask to "L" channel to sharpen image. Be careful to not bring back any residual pattern. Be sure to apply the 100% Fade on the Luminosity after each unsharp mask if you apply unsharp mask to a composite RGB image.

Some Descreening Tips

Tip#1

View each effect on the whole image and up close at the pixel level to help you judge the effect of the current move and provide guidance for the next adjustment you may want to make. Usually one of the RGB channels will show the original halftone dot pattern less than the other channels. This less affected channel will require fewer repairs than the other channels. Repair this channel by itself with the minimum amount of alterations possible. Then use this channel to help maintain the sharpness and integrity of the final image.

Tip#2

When you find a descreening sequence which works for a type of image, record the sequence of alterations as a Photoshop® Action. This action can then be easily played back on other images. If you are not familiar with this function in Photoshop®, please refer to Adobe's Photoshop® manual and Help File.

Additional correction after the scan

You may want to save the Unsharp masking and RGB to CMYK conversion for Photoshop®, depending upon how much image editing you plan to perform in the post scan in Photoshop®. The more editing and correction you intend to do, the more appropriate it is to work in RGB (or Lab) and save the mode conversion and unsharp–masking for Photoshop®.

• Perform any desired image edits or combinations in Photoshop®.

• Perform unsharp mask in Photoshop® after final image editing.

Note: Since the grayscale value adjustment which occurs during the application of an unsharp mask tool affects not only the contrast but

the color values as well, color shifts can occur along sharpened edges within an image. Color shift problems along edges can be avoided by: 1) performing unsharp mask on individual lower contrast channels, 2) performing unsharp mask on "L" channel in Lab mode, or 3) fading unsharp mask to 100% Luminosity in Photoshop® Filter menu (Filter–Fade unsharp mask–100%–Luminosity).

What we have explored above is how to create consistent, high quality color images which will print well on standard commercial presses. Additional color correction can be done to enhance specific portions of an image such as skin tones and/or certain memory colors such as grass and sky.

AUTOMATED COLOR MATCHING AND CORRECTION

Concept:

In addition to the manual scanning controls which we have been using thus far, UMAX also offers automatic scanning capabilities. UMAX has two types of automation, (1) MagicMatch, which offers on-the-fly color space conversion from RGB to other color spaces, and (2) binuscan IPM (Image Processing Machine) which offers fully automated scanning as well as color space conversion.

Figure 78 MagicMatch
MagicMatch is selected by clicking on the MagicMatch button in the upper right hand corner of the Scanner control palette. When activated MagicMatch offers several color space conversion options not available while in Manual Control.

MagicMatch

MagicMatch is selected by clicking on the MagicMatch option in the top right-hand corner of the Scanner Control Palette (Fig. 78). Once activated MagicMatch offers several other scan/conversion modes not available when working in Manual Control. Look at the scan mode pull-down menu (Fig. 78), and you will see that previously unavailable choices such as TrueColor CMYK, RGB, and CIE Lab are now available. These three menu choices are really a combination of scanning and color space conversion selections and not just scan modes. Your scanner will still capture your image as an RGB image, and will then convert it on-the-fly to the color space you have selected. All you need to do is select the portion of the image which you want scanned and then the MagicMatch portion of the MagicScan software sets up and performs the scan and then converts your RGB image to the color space you have selected. Most of the manual set up and image

Figure 79 CMYK Conversion
If you select the CMYK conversion choice option in MagicMatch, it is important to select a printer form the "Printers" menu at the bottom of the Scanner Control palette which most closely resembles you printing device. Selected here is the 3M MatchPrint proofing device, which is a common proofing device used in commercial offset printing.

enhancement controls we have utilized in the Color Contone section (starting on page 34) are not available. You will also note that MagicMatch does not support the scanning of negative images. Manual Control or Auto Correction/binuscan must be selected in order to scan negatives.

If you like the setup and scan choices which MagicScan offers, then use this scan mode. If, however, you want to take more control of the scanning setup, then choose the Manual Control mode.

Following is a brief description of each MagicMatch color space and some notes on their use.

TrueColor CMYK

This MagicMatch selection is used to convert your images directly into a CMYK color space after your scanner captures your images. CMYK is used for the printing of your images on CMYK desktop color printers, and commercial printing presses. If you select the CMYK conversion choice, you will notice that a printer's menu will appear at the bottom of the Scanner Control palette (See Fig. 79). If you use the CMYK conversion choice, it is important for you to select from this menu the printer description which is closest to the device on which you will be printing your image. If you intend to print your image on one device, that device appears in the printer's list, and if you do not intend to use your image for other purposes, (a Web page, printing to a film recorder, or CMYK printing device) this CMYK conversion choice may be a good method to use. If however, you intend to reproduce your image on several different devices, converting your scanned image immediately to a specific CMYK color space may not be the best approach. Converting an image to a specific CMYK color space will tend to restrict the color values in the image to that specific device and reduce the number of colors which can be reproduced on other devices. (See the discussion of multipurposing of images below.)

RGB

RGB is a very restricted monitor color space. This conversion mode should be chosen only if you intend to use your images for projection on 8-bit (256 color) color monitors or projectors. If you intend to print your images on CMYK or other RGB devices such as 16-bit (thousands of colors) or 24-bit monitors (16.7 million colors), do not choose this conversion mode.

CIE Lab

CIE Lab is a large color space defined by the limits of human vision, and used by numerous color management systems. It is a wonderful, though not widely used, image editing/color correction space. If your color management software utilizes this color space, or you happen to have the ability to work in Lab mode with your post-scan images this is a good color space. CIE Lab is also a good archive color space in which to save your images if you intend to use them for multiple purposes. (See the following discussion on multipurposing of images)

Multi-purposing of images

During most of the history of professional scanning and commercial printing, and in the early days of desktop publishing, most of our scanned images were converted directly to CMYK, and most often during the scanning process. This is still a viable approach if you intend to print to only one type of device, such as a commercial printing press. The recent and continuing trend of the explosion of electronic publishing into all areas of graphic communications allows us to reproduce our images on many different types of devices, including RGB film recorders, Web pages, and a dizzying array of desktop color printing devices. Many of these new devices are able to reproduce a wider range, or gamut, of colors than standard commercial printing presses. As a result, it is not always appropriate to convert directly to CMYK, as in doing so you may inadvertently reduce significantly the range of colors which you may be able to reproduce on other devices. And if you work exclusively in the world of RGB (Web pages, film recorders, monitors and projectors), conversion to CMYK is totally unnecessary.

If you intend to multi-purpose your images, that is, use them on multiple devices, a good approach is to capture/create your images initially in a large color space such as TrueColor RGB or CIE Lab. This initial image can be saved as a wide gamut color archive image from which copies can be made to reproduce on a wide variety of devices. For instance, RGB to CMYK (for printing) or RGB to Index (for Web use) conversion can be accomplished through Photoshop® or other imaged editing/correction applications.

Auto Correction/binuscan IPM

This is a completely automated scanning and color space conversion option available with UMAX's professional scanners. The binuscan IPM (Image Processing Machine) must be installed on your comput-

er. Please see the PhotoPerfect manual for installation and operation instructions. The knowledge gained by learning manual scanning will help you in fine tuning this automated software.

CONTONE SCANNING RESOLUTIONS

Figure 80 Scan Resolution and Scaling Dialog Box

Use your scanner's software to determine the final resolution of your image. And whenever possible let the scanner perform your scaling chores as well. Your scanner will do a better job, and do it faster than a post-scan image-editing application like Photoshop®.

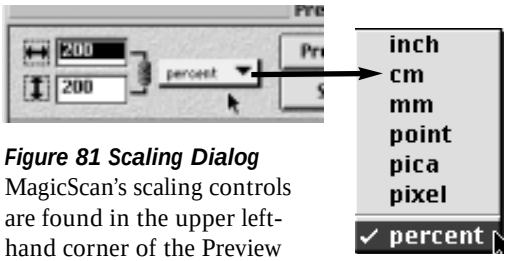


Figure 81 Scaling Dialog

MagicScan's scaling controls are found in the upper left-hand corner of the Preview window. Units can be chosen to suit your needs.

Concept

Output resolution in lines per inch (known as lpi or line screen) should control the input scan resolution in pixels per inch (ppi). When multi-purposing images, use the resolution of the most demanding device (usually a printing press) to perform your scan. Then make copies of your original image and down-sample the image resolution to match the requirements of less demanding devices (laser printers, WEB images, etc.).

Commercial and Desktop Printing of Halftones

Standard halftone (AM) Screening

Formula: 1.5 x lpi x scaling factor

Example 1, no scaling: 1.5 x 150 lpi x 1 (no scaling) = 225ppi

Example 2, with scaling: 1.5 x 150 lpi x 2 (doubles image dimensions 4"x5" to 8"x10") = ~450ppi

Best results will occur if you let your scanner do the scaling for you. For instance, you would set your scanner resolution for 200ppi at 200% for example 2 above (see Figures 80 and 81). The exception to this is when you scan previously screened/printed images. These should usually be scanned at a higher and odd resolution, with the expectation that the resolution will be lowered in Photoshop® after the scan.

Stochastic (FM) Screening

There are no line screens in FM printing, so we use final resolution to help determine input scan resolutions. For printing to large format inkjet printers, final resolution should be between 100 –150ppi after scaling. A good average is 125ppi. For finer-grained FM printing on offset presses, higher resolutions, 150–175ppi, may be required. Consult your printing company or service bureau for their specific guidelines.

Other Output Devices

In addition to the standard dot printing devices such as commercial presses and laser printers which use dots to reproduce images, there is an increasing array of desktop output devices, such as dye sublimation and ink jet printers which do not use standard dots for image reproduction. In addition there is a proliferating array of software drivers which may supply scaling functions to images during the printing process. Because there is such a wide variety of printing technologies available to us, it is difficult to offer specific number advice for scanning resolution for all desktop devices. But here are some guidelines.

1) Most desktop printing devices require resolution in the range of 100ppi to 300ppi in the pixel-based image.
2) Test your output device at a number of resolutions. For instance, you might try printing with 100, 150, 200, 250, and 300ppi. Then use your experimental tests to judge which resolution is the one that you need. Choose the lowest resolution which gives you satisfactory results. Often you will find that you will not see any improvement in image quality past a certain resolution. You may be surprised how low you can go with some of the new printers and their technologies. If you are sending your files out to a service bureau for printing, be sure to consult them for advice on image resolution.

DOT GAIN

Concept

Images tend to print darker than they scan. This is because ink and toner tend to spread out when they are applied to paper, making our halftone dots larger and our grayscale values darker. This spreading out of ink and toner when it is applied to printing substrates is known as dot gain. In general we need to lighten our images prior to printing them so that they print and view at their proper grayscale values.

Dot Gain Correction

Correction for dot gain can occur in any number of places, including: during the scan, in an image-editing application like Photoshop®, during gamut conversion for color images, or even during the RIPing

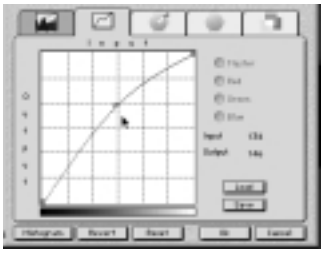


Figure 82 Dot Gain Correction Curve
A curve which overall lightens an image prior to printing it should be applied to each image in order to compensate for dot gain. The amount of lighten, or dot gain adjustment, required depends upon several variables, including the ink or toner used and the paper or other substrate on which the printing occurs. For example, uncoated papers tend to require more dot gain correction than coated papers.

process itself. Regardless where the correction occurs the typical tool is nearly always the same. Dot gain correction usually involves applying a curve to lighten the image prior to printing. If you are multipurposing your images, it may be best to apply the dot gain correction lightening curve after the scanning process, so that you can accommodate the dot gain requirements of more than one output device. Post scan application of a dot gain correction curve will also allow you to avoid the creation of nonprint images which appear to light.

1) To apply a dot gain correction during the scanning process you can create or load a curve similar to the one in Fig. 82 with the curve tool (Image Enhancement tool window). Click the Load button to select a save curve. You can download Photoshop curves or ones created in MagicScan.
2) Alternatively you can increase the midtone number on the gamma curve to affect a dot gain correction lightening effect. But be aware that by applying dot gain correction through your gamma curve you would be linearizing your scanner to a specific output device rather than to your monitor. This can be a helpful, time-saving procedure if you are printing to only one device, but can create problems if you are outputting to several devices.
3) Dot gain correction can be applied in Photoshop® or other image-editing applications through the creation or loading and application of curves or transfer functions.
4) If you are sending your graphic images out to a service bureau or printing company, call and ask them if they will be applying dot gain correction to your images. If they want you to apply the correction, ask them how much of a curve you should apply.
5) If you are printing in-house on your own printers, you may want to experiment with several curves to see which one gives the best results.

Note: It is always a good idea to archive original, non-dot gain corrected images somewhere, in case you need to use your images again on other devices which require different, or no, dot gain corrections.

MULTIPLE SCANS

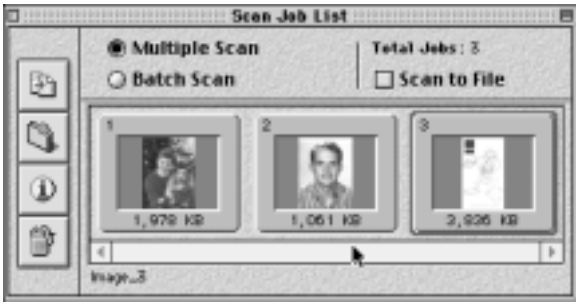


Figure 83 Multiple and Batch Scans
MagicScan allows you to scan more than one image at a time or scan the same image several different ways. Separate frames are set up for each scan made.

You can improve your productivity through Multiple and Batch scanning. These scanning tools allow you to scan more than one image at a time or scan the same image in multiple ways. To take advantage of the scan tools, activate the Scan Job List tool from the Window menu (see Fig. 83). Multiple or batch scan settings are set by creating additional scan frames. This can be done by creating a new scan frame from the Image menu (Fig. 17), or by using the scan frame tool in the Preview window (Fig. 22 on p. 17).

Multiple scanning

Multiple image scanning involves setting up a scanner to capture multiple images during one scanning pass, using individual scanner setups for each image. With multiple scan, you get the highest quality because the scanner will calibrate before capturing each image.

Batch scanning

Batch image scanning also captures multiple images during one scanning pass, using the same individual scanner setups for each image. With batch scan, you get the fastest speed because it does just one calibration upon starting the project. In either case, separate frames are created for each scan frame.

SCANS FOR WEB IMAGES

Two approaches to scanning for Web imaging

Scan for print and then convert a copy for the Web

A good approach is to start by scanning an image for the highest resolution needed, which is usually print. Then, make a copy of the image and then prepare that image for the Web. This Web preparation usually involves down-sizing, resolution reduction, a mode and color space adjustment, and a file format change. This is a good procedure to use because images are often and sometimes unexpectedly used for multiple purposes.

Scan directly for the Web

If you know that you will only use an image for the Web, use the same techniques for line art, grayscale photographs and color photographs discussed earlier, keeping the following in mind:

1) Scan the images at the largest format size that you will need for use on a web page. Note: you can always copy and downsize them later without loss of image quality.

2) Scan the images at 72ppi, but make sure that you create them at the size at which you will use them. No scaling up will be possible without noticeable image degradation. You may choose to scan at a much higher resolution if you are working in a real-time high-resolution image-editing software, like Live Picture.

3) Do not go through any gamut conversion to CMYK. Capture your images in RGB or CIELab mode.

4) If you are scanning directly for the Web, final image preparation for the Web still usually involves a mode and color space adjustment and a file format change. Take this more direct approach if you are working on a web-only project.

TECHNICAL SUPPORT

If you have trouble with your UMAX scanner, or trouble getting your software drivers to access your scanner or work correctly, please contact UMAX via the Web at www.umax.com, then choose "Support".

Technical Support Hours are M-F: 6am to 5pm Pacific Time.

The web address is http://www.umax.com.

Tel: 1.800.468.8629 or 510.651.8883

Fax: 510.651.2610

Email: support@umax.com

TRAINING SUPPORT

Consulting Help

If you would like some advice from Taz Tally on scanning problems you are having, UMAX has arranged for you to have access to Taz's expertise at a special low rate. Contact Taz via email at ttallyphd@aol.com for more information.

Training Seminars

If you are interested in attending a seminar to obtain first-hand training on scanning and other image creation and editing techniques, you may attend a UMAX-sponsored Taz Tally Seminar. You may obtain a UMAX-sponsored discount for seminar attendance by mentioning that you saw this information in a UMAX scanner manual when you sign up for a seminar. Contact Taz Tally Seminars at 888.624.0100 or visit the website at www.tazseminars.com.

Educational Materials

If you are interested in obtaining other training materials such as interactive training CDs, videos, books as well as minicourses and online training, visit www.tazseminars.com.

SCANNER MAINTENANCE AND SAFETY

One key to having a consistently performing scanner is to follow a few simple maintenance and safety precautions.

Maintenance

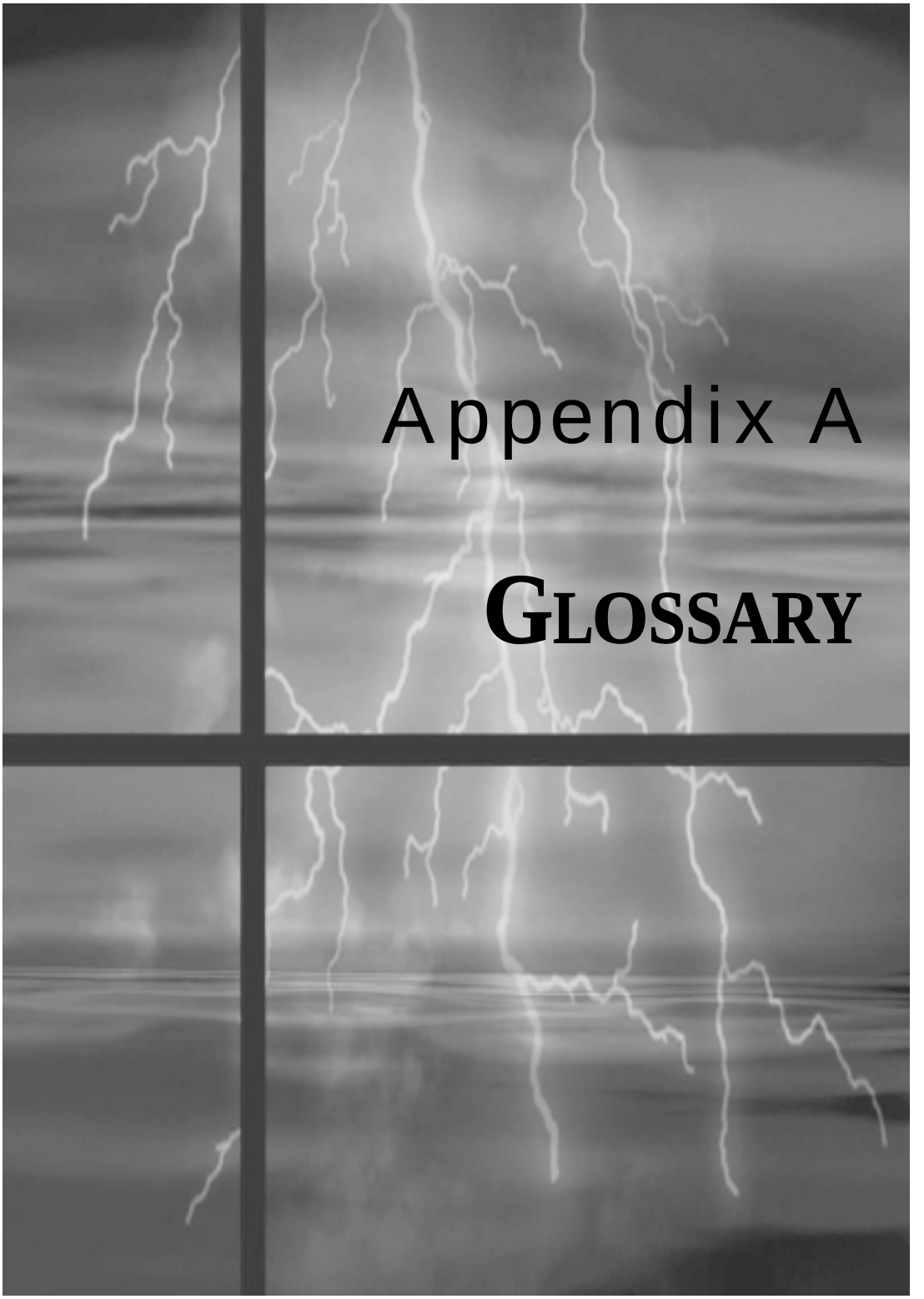
A clean scan bed is a first step to high quality scanning. At the beginning of each scan session you should clean the glass surfaces which will be in contact with your image. If you are scanning reflective art you need to scan the lower glass scan bed. And if you are scanning transparencies, you will need to clean both the upper and lower glass plates. The PowerLook 3000 has only one glass surface to clean. Use a lint free cloth, (we recommend silk) and a streak-free optical cleaning solution. Spray a bit of the solution on the silk cloth and then clean the glass surface(s). Do not spray any liquid directly on the scanner surface. It is also a good idea to have your scanner in a dust-free environment with constant temperature and moisture, if possible. Dust-heavy environments may eventually lead to dust getting into the scanner and settling on the inside of the glass, and perhaps affecting the scanner operation.

Cleaning the outside of the scanner should also be done with a cloth on which you have sprayed a non-corrosive cleaner such as pure water or water with a mild cleaner. Be sure to unplug your scanner before cleaning.

Safety

Electrical safety is of primary importance. DO NOT plug your scanner into an outlet which does not have a grounding plug. Three prong sockets are grounded and should be used. It is also a good idea to attach your scanner to your computer before you plug it into an electrical outlet. Plug both devices into their electrical outlets before you turn them on.

The easiest way to damage you scanner is to treat it roughly when you move it. First, never move your scanner while it is operating. Prior to moving your scanner, and particularly if you intend to travel any distance, be sure to lock the optics in place. This is done by turning the lock slot(s) into their locked position. Reflective-only scanners will have one lock slot. If your scanner has a transparency adapter, there will be one or more additional locks. There is no lock on the PowerLook 3000. Please refer to your hardware manual for the location of the lock slots on your particular scanner.



Appendix A

GLOSSARY

SCANNING GLOSSARY

bit depth: The number of bits of image information in an image. Black and white images have 1 bit per pixel. Grayscale images typically have 8 bits per pixel. RGB images usually have 24 bits per image (eight in each of the three RGB channels) while CMYK images typically have 32 bits per image. If the bit per pixel increases in an image, the total image bit depth increases as well. For instance, an 8-bit per pixel RGB image has a total image bit depth of 24 bits, while a 10-bit per pixel image will have a total image bit depth of 30 bits per image. See *Capture bit depth*.

Bitmap: A type of file, usually photos or artwork of some sort, that is composed of pixels. This type of format allows for a continuous tone and fine detail to be possible on the computer. Examples: TIFF, Paint, PICT.

Capture bit depth: The number of bits per pixel which an image capture device such as a scanner or digital camera can capture. Typical capture bit depths are 8, 10 ,12 and 14 bits per pixel. The higher the bit depth the more image information is captured. Often capture bit depth is expressed as the total number of bits captured in a three-channel RGB image, where a 10-bit per pixel capture bit depth is expressed as a 30-bit capture bit depth for the combination of all three channels.

Calibration: The adjustment which must be done to make sure that a scanner or digital camera will properly capture an image. Fundamental calibration techniques usually involve linearization and neutralization.

Channel: A single, usually 8-bit grayscale portion of an image. There are two kinds of channels, Color and Selection channels. Color channels are the fundamental building blocks of color images, while selection channels are created from selections. Channels are often saved.

Color cast: The presence of color when none should be there. Color cast is typically identified when a neutral or gray portion of an image has unequal amounts of red, green or blue. Fixing a color cast is called neutralization. There are two types of color cast, scanner and image casts, which should be adjusted separately. See *Neutralization*.

Contone: Abbreviation for continuous tone image. Contone images typically contain a variety of gradually changing grayscale values, unlike a line art images which are typically flat looking with few if any shades of gray. A photograph is a typical example of a contone image. Contrast with line art.

Curve: A line graph which controls the ratio of input to output values for grayscale values in an image. A curve is often used to control the brightness and contrast of images and is used to adjust the distribution of grayscale values in individual color channels to accomplish color correction.

DMax (Maximum Density): Measurement is often used to state the darkest shade of gray which an image capture device can distinguish. Instruments with high dynamic ranges usually have high DMax's as well. See *Dynamic Range*

Dot (halftone dot): The building block of continuous tone-printed images. Halftone dot resolution is usually commonly referred to as line screen or LPI (lines per inch). Typically line screens in commercial printing vary from 133 lpi to 150 lpi. See *Output resolution*.

Dot gain: The tendency for halftone dots to "grow" or enlarge when they are printed. This dot gain occurs because ink and toner tend to spread out when they are applied to printing substrates. Dot gain results in images which print darker than they scan and view.

Dot gain adjustment: The lightening of an image, usually through the application of a lightening curve, to precompensate for the darkening which will occur when a halftone dot-based image is printed.

dpi: A commonly used general term for resolution. DPI is often used when other terms are more accurate and useful. See *ppi, Spot, Dot,* and *Res.*

Diffuse highlights: Lightest portion of an image which still has detail. This is the most important highlight portion of an image to be captured and preserved. See *Specular highlight*.

Dynamic Range: The range of grayscale values, from black to white, which can be captured by a scanner or digital camera. The dynamic range scale is a logarithmic scale ranging from 0 to 4.0 with 4.0 being the highest. Image capture devices which have high dynamic range can distinguish wider range or grayscale values than devices which have low dynamic range. Low dynamic range devices, with dynamic ranges <3.0, typically have a difficult time distinguishing shadow details in images.

Edge reproduction: The main focus of scanning line art. Reproducing the edge of line art is the key to good line art scans. Using the optical resolution of the scanner is often a key to accurate reproduction of line art edges.

Final scan: A scan performed at high resolution after an image has been viewed, cropped, analyzed and set up using a low resolution preview scan. See *Preview scan*.

Gamut: The range of reproducible colors which a device has available. A color monitor usually has a larger color gamut than a CMYK printer; therefore there are colors which we can see and produce on a color monitor which we cannot reproduce on the CMYK printer.

Gang or batch scan: Scanning multiple images in one pass with all images having the same identical settings.

Gray map: A chart, usually a histogram, which shows the distribution and frequency of the grayscale value in an image.

Grayscale reproduction: The main focus of scanning contone images, such as grayscale and color photographs. Scanner calibration, linearization and neutralization, as well the as setting of proper highlight and shadow points are keys to accurate reproduction of grayscale values.

Halftone: An image which is built out of a pattern of halftone dots. Continuos tone images such as photographs cannot be printed as a continuous tone on a printing press, so they are reconstructed out of patterns of dots. These dot patterns are small enough so that they appear as a continuous tone image when viewed at the proper distance.

Highlight Point–Diffuse: The lightest portion of an image which contains details. A diffuse highlight area contains significant grayscale value or information, and will print as a light value of grayscale, which will show details. An example would be the lightest portion of a white shirt. The typical range in which a shadow point will fall is 3% -15% grayscale.

Highlight Point–Specular: The lightest portion of an image which contains NO details. A specular highlight area contains little or no grayscale value or information, and will print as pure white with no details. An example would be a reflection off of a chrome bumper. A typical grayscale value for a specular highlight is 0% gray.

Histogram: A chart with highlight, mid-tone and shadow sliders which displays the frequency and distribution of grayscale values in an image. A histogram is often used for setting the highlight and shadow points in an image.

HSV/L: Hue, Saturation and Value/Lightness are used to describe the color of a pixel. Hue is the basic color determined by its frequency or wavelength of light. Saturation is a measure of the the intensity or purity of the color and is controlled by the amount of white color added to the basic color. Value or Lightness is measure of the grayscale value of the color.

Input resolution: Resolution terminology used to refer to images which have been captured or created as pixel-based images. Usually expressed as the number of pixels per inch (ppi) or pixels per millimeter (Res). See *Input resolution*.

Intensitometer: A tool, often called a densitometer, which is used to measure the grayscale values of pixel-based images.

Line art: Line art images are typically flat looking with few if any shades of gray. A logo or pencil drawing are typical examples of line art images. Contrast with contone image.

Linearization: Adjusting, or calibrating, a scanner so that it will capture grayscale values with their proper values. For instance, a linear scanner will create a 35% pixel when it "sees" a 35% grayscale value. A non-linear scanner will capture grayscale values other than 35% when it "sees" a 35% grayscale value. Typically, uncalibrated/nonlinear scanners create pixels which are darker than the original grayscale values of an image. For example, an original 50% grayscale area may be captured as a 60% gray by a nonlinear scanner.

Midtone: Tonal range of an image which centers around 50% gray scale. Grayscale values in an image roughly in the range of 35% to 65% gray scale are considered to be in the midtone region.

Multiple Scan: Scanning multiple images in one pass with each image having its own separate scan settings.

Neutralization: Adjusting, or calibrating, a scanner so that neutral portions of an image will be captured as neutral, rather than having a color cast. A neutral area will have equal RGB values. A non-neutral area will have unequal RGB values. For instance, a neutral 5% gray area should have RGB values each equal to 5%.

Optical resolution: The true or hardware resolution of an image capture device such as a scanner. Using the hardware resolution of a scanner results in faster and more accurate scans. Scanning at other than the optical resolution of a scanner results in interpolated pixels, which are manufactured and therefore less accurate.

Output resolution: Resolution terminology used to refer to images which have been recreated or printed as spot-based and dot-based images. Usually expressed as the number of spots or dots per inch (dpi) or halftone dots per inch or lines per inch (lpi).

Pixel: Basic building block of a bitmap image.

Ppi (pixels per inch): the most common term used to express correctly the resolution of a digital image.Ppi refers to the number of pixels per inch both horizontally and vertically in an image. See *Input resolution*.

Preview scan: Low resolution, usually 72ppi, overview scan which is done at the beginning of a scan session. This previewed image is used to locate and crop the image to be scanned and set up the scanner for the final high resolution scan. See *Final scan*.

Quartertone: Tonal range of an image which centers around 25% gray scale. Grayscale values in an image roughly in the range of 15% to 35% gray scale are considered to be in the quartertone region.

Res: A less commonly used input resolution term which designates the number of pixels per millimeter in a digital image.

Resolution: The number of building block components per unit distance, such as dots per inch (dpi) or pixels per inch (ppi) in an image. Resolution should be distinguished as either input or output resolution. See *Input resolution* and *Output resolution*.

RIP: Raster image processor. The hardware and/or software device through which all document components, including line art, contone images and text, are processed in order to convert them into printed images.

Scan mode: Determines the pixel depth and color space in which an image will be captured or converted into, including: 1-bit (B&W lineart), 8-bit (grayscale), 24-42-bit(RGB), 32-bit (CMYK).

Scanner: Capture device which converts analog images into digital pixels.

Shadow point: The darkest portion of an image which still has details in it. The typical range in which a shadow point will fall is 85% -100% grayscale.

Specular highlight: A featureless highlight portion of an image containing no details. See *Diffuse highlight*.

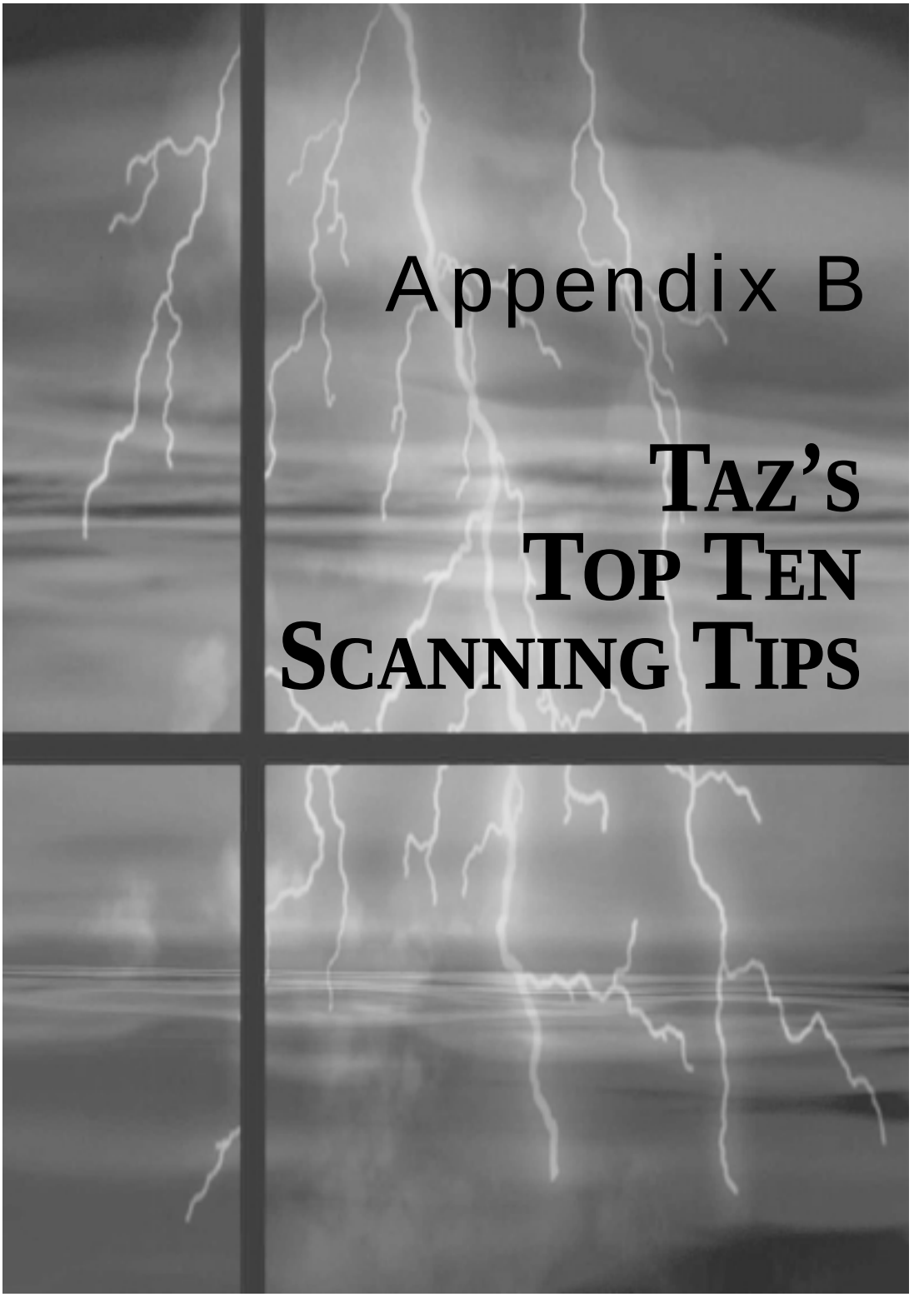
Spot: The smallest building block of a printed text or line art image. Often expressed as dpi (dots per inch). A 300dpi laser printer has spots which are 1/300" across, while a 2400dpi imagesetter has spots which are 1/2400" across. See *Output resolution*.

Streamline: A program from Adobe® Inc. which is used to convert pixel-based images into vector-based line art. Sometimes used as a verb in "streamline an image."

Three-Quartertone: Tonal range of an image which centers around 75% grayscale. Grayscale values in an image roughly in the range of 65% to 85% gray scale are considered to be in the quartertone region.

Tone compression: Setting the highlight and shadow points of an image which will determine where the captured grayscale values will be placed in an image.

Unsharp mask: A software filter used to increase the sharpness or focus of an image. Most digitally-captured images need to have sharpening applied in order to return an image to its original sharpness.



Appendix B

TAZ'S TOP TEN SCANNING TIPS

TAZ'S TOP TEN SCANNING TIPS

Scan Tip # 1

Always clean your scanner's imaging surface prior to starting a scan session. This should be accomplished using a mild solution and a lint free cloth.

Scan Tip # 2

Perform basic image correction functions, such as calibration, setting highlight and shadow points, and adjusting image brightness and contrast, during the scan rather than after the scan in an image-editing application such as Photoshop®.

Scan Tip # 3

Calibrate your scanner at the beginning of each scan session. Linearize for grayscale, and linearize and neutralize for color images to improve image brightness and reduce color cast problems.

Scan Tip # 4

Use the optical resolution, or 1/2 of the optical resolution, of your scanner when scanning line art, and especially when scanning simple and intermediate line art images which you intend to convert to vector-based images.

Scan Tip # 5

Use an editable histogram when setting your highlight and shadow points in a contone image. Highlight values should be set so that the lightest portion of an image which has detail will print as its proper grayscale value. The shadow values should be set so that the darkest portion of the image which still has detail will not fill in and print black. Typical highlight and shadow values for commercial printing are 5% highlight and 90% shadow.

TAZ'S TOP TEN SCANNING TIPS

Scan Tip # 6

Use a curve tool when adjusting your image brightness and contrast. This brightness and contrast adjustment should be performed after the highlight and shadow points are set. Do not adjust the end points of the curve during brightness and contrast adjustment, as this will destroy the highlight and shadow settings.

Scan Tip # 7

Apply unsharp mask to both grayscale and color contone images to improve the sharpness of those images. On color images it is a good idea to apply unsharp mask to only the grayscale portion of the image, in order to prevent color shifts along high contrast edges.

Scan Tip # 8

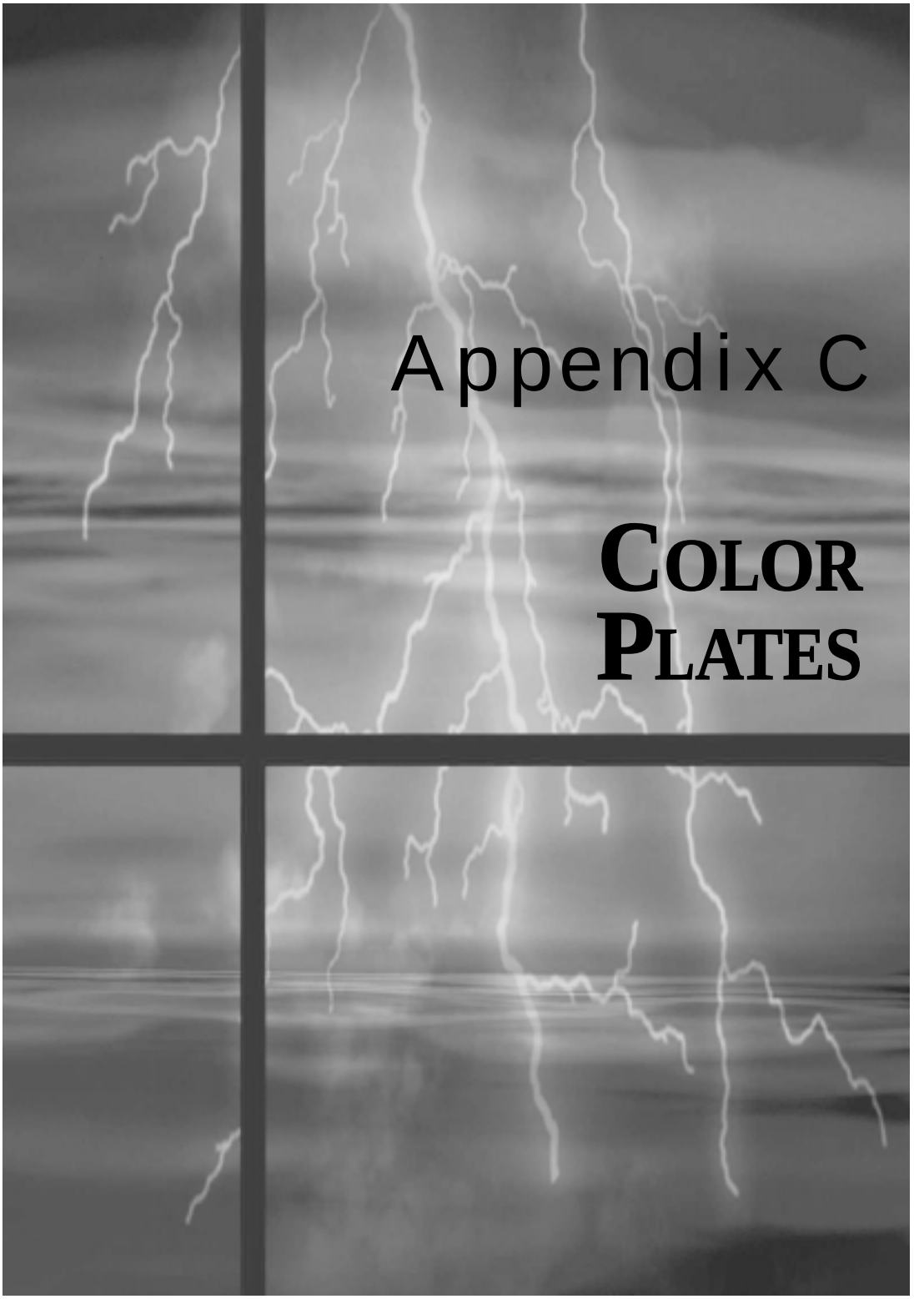
Scan detailed line art images in greater than 1-bit, black and white, mode. Use 8-bit+, grayscale, for detailed black and white images, and 24-bit+, RGB, for colored line art images. Scanning detailed line art in multi-bit modes allows for more flexible post-scan control and image editing.

Scan Tip # 9

When setting highlight and shadow points for color contones, for best results, adjust the placement of the highlight and shadow pointers on individual channels rather than on the composite channel.

Scan Tip # 10

Neutralize grayscale portions, such as white highlights, of color images in order to remove color cast from color images, and improve overall color balance of the image.



Appendix C

COLOR PLATES

Color Figures 61-C and 62-C

Seen here are the color versions of Figures 61 and 62 found on page 48 in the manual. The “C” designation refers to the color version.

Figure 61-C Original Color Photo

Bordered number areas are reference areas in text.

Before Correction ***After Correction***

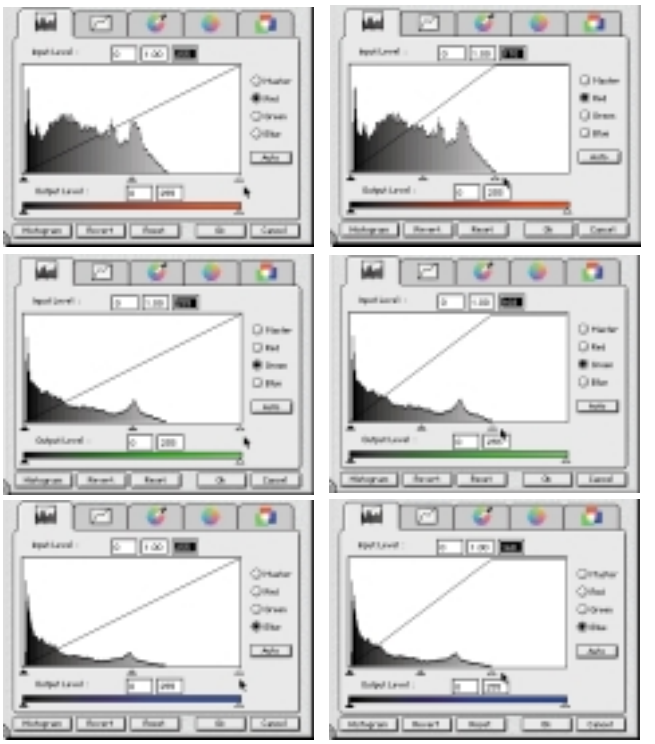


Figure 62-C Setting Tone Compression

Setting highlight and shadow points should be performed on individual channels, as shown above, rather than on the Master Channel. As a starting point set the highlight and shadow points visually by placing the highlight and shadow pointers at the beginning and the end of the image data in the histogram. These highlight and shadow points can be fine tuned using the Info palette either here in the histogram or later with the curves tool.

Color Figures 63-C, and 64-C

Seen here are the color versions of Figures 63, 64 found on pages 49 in the manual. The “C” designation refers to the color version.

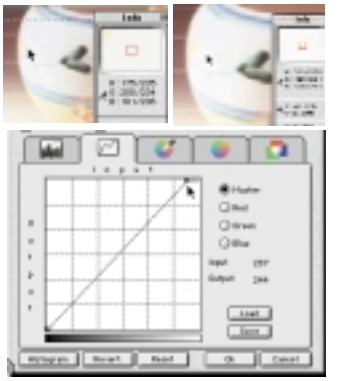


Figure 63-C Highlight Adjustment

Here we are raising the highlight value using the Curve on the Master channel. This will raise all three (RGB) values simultaneously. Adjust the position of the highlight end of the Curve until all the right side RGB values of the Info tool ~242 (right).

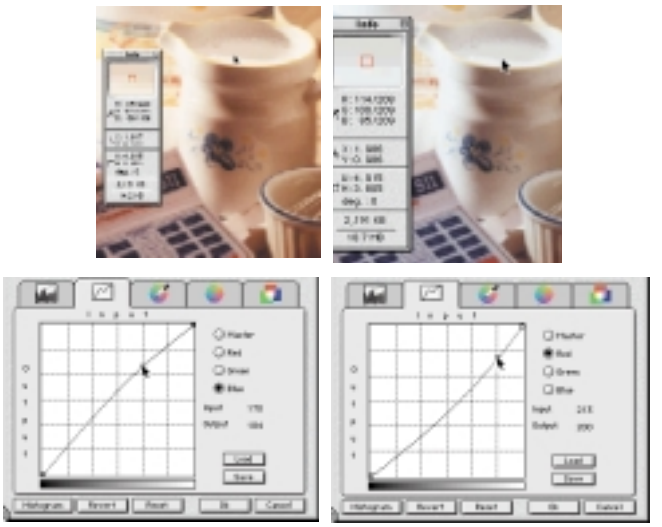


Figure 64-C Neutralization of Quartertone

Here we are raising the highlight value using the Curve on the Master channel. This will raise all three (RGB) values simultaneously. Adjust the position of the highlight end of the Curve until the the right side RGB values of the Info tool ~242.

Color Figure 65-C and 66-C

Seen here are the color versions of Figures 65 and 66 found on pages 50 and 51 in the manual. The "C" designation refers to the color version.

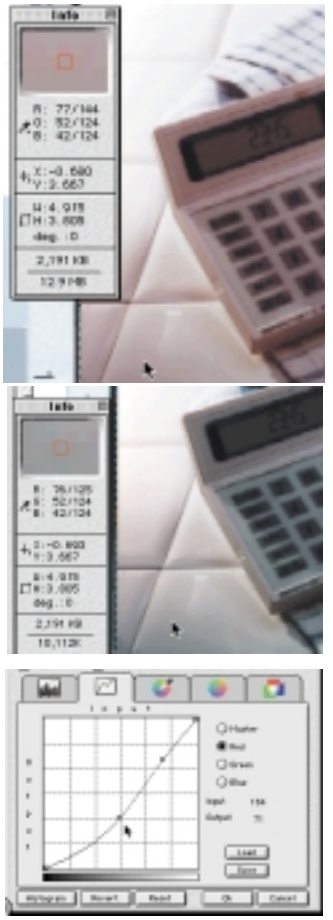
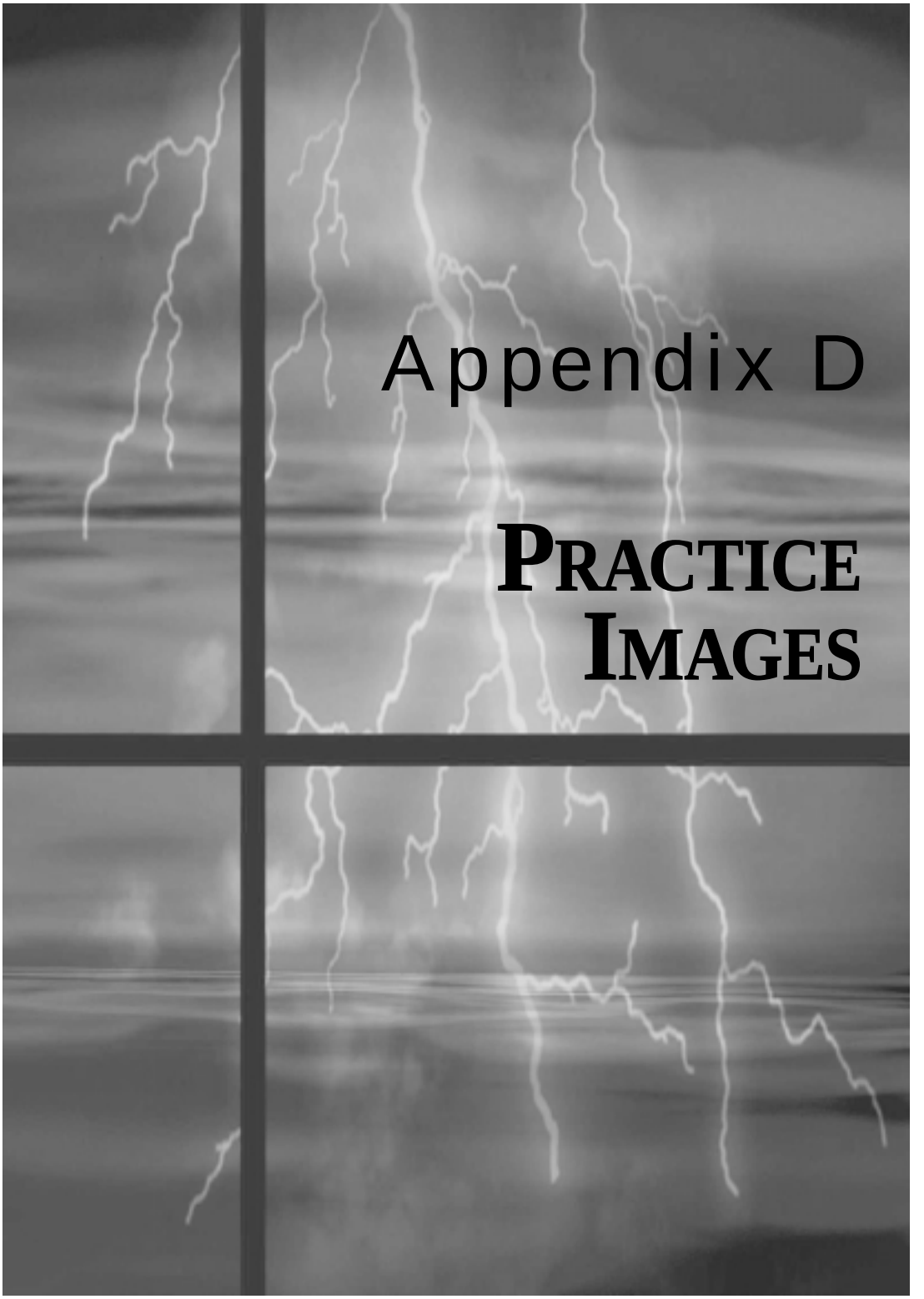


Figure 65-C Neutralization of Midtone

Here we are measuring and adjusting a neutral area in the midtone region of the image. In the top, uncorrected image, the histogram shows a high Red value of 144 compared with the 124 for the Green and Blue values. To correct this excess of Red, we activate the Red curve, and lower the curve in the midtone until the Red value ~ 124. The second, corrected image shows all three, R,G,B values = 124.

Figure 66-C Raw and Final Images

The top image was the image created with a Raw scan, without corrections. The bottom image is the result of the tone compression, color correction and unsharp mask performed in this chapter. Note how the top image has a distinct red color cast, and is darker and lower contrast and appears to be out of focus when compared with the lower, adjusted image. Compare your final image with the results seen here. Remember that an accurate printed version of your RGB scan will depend upon a correct RGB to CMYK conversion.

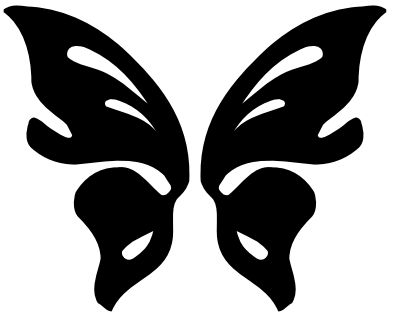


Appendix D

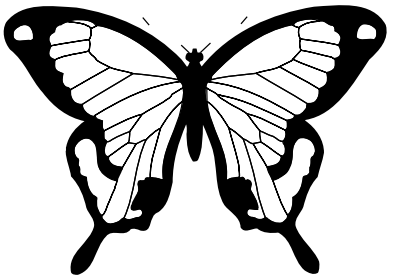
PRACTICE IMAGES

PRINTED PRACTICE IMAGES

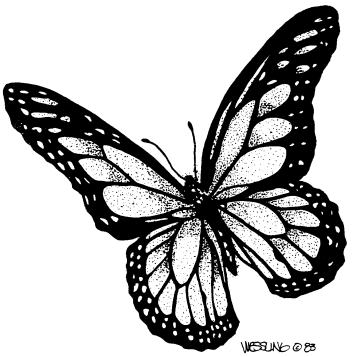
Use the three (3) line art images below on this page as your practice line art images. Use the printed/halftoned versi on of the photograph below in the descreening exercise in Chapter III. These are the same images used in the Chapter III hands-on section of the manual. Use the grayscale and color photographs found in the image pocket attached to the inside of the back cover of this manual as your practice images for scanning grayscale and color original images. Use the grayscale target, also stored in the back cover pocket, for calibrating your scanner.



Simple, Low Detail Line Art Image



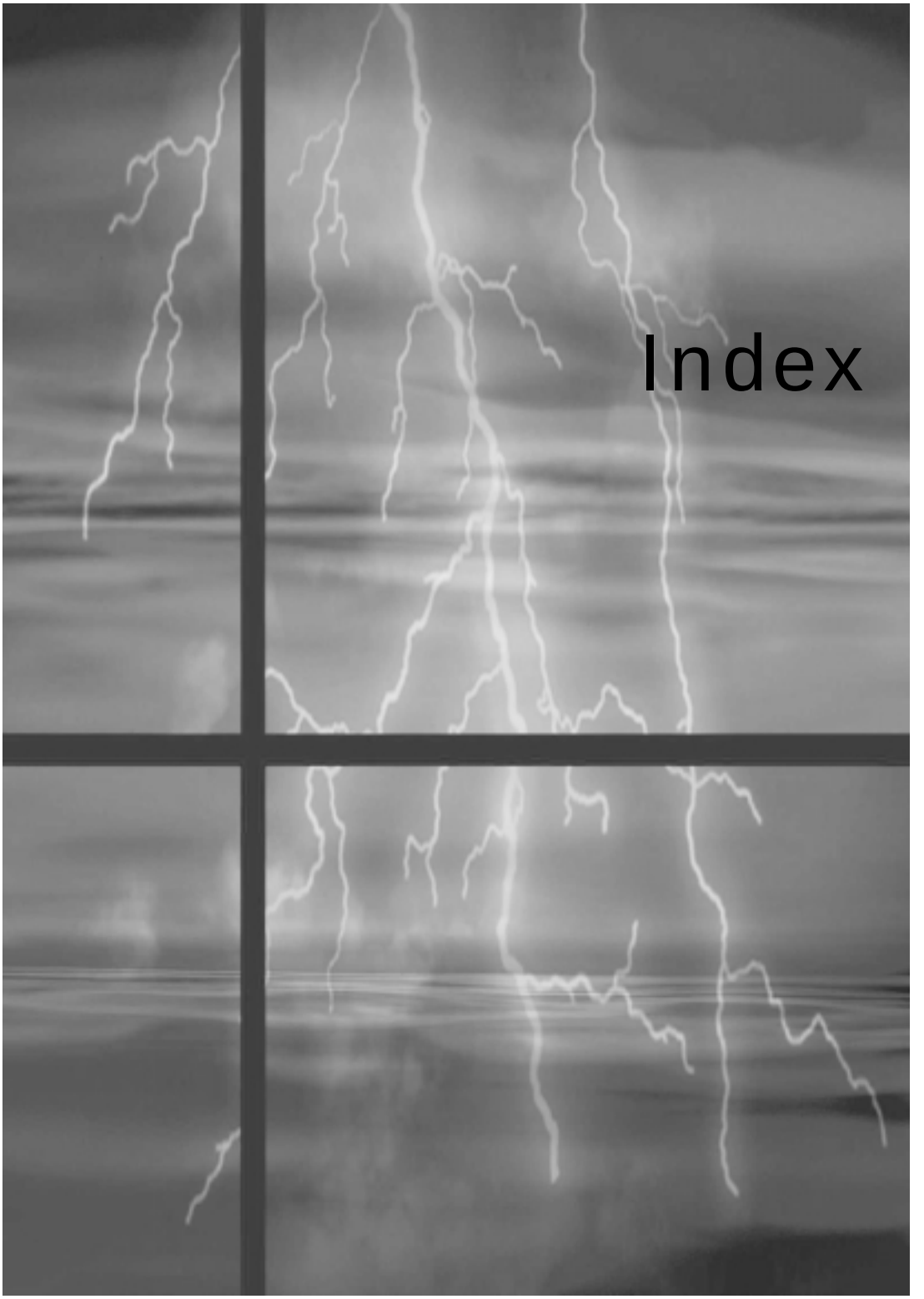
Intermediate Detail Line Art Image



High Detail Line Art Image

Low Edge Quality Line Art Image

Printed/halftoned Contone Image



Index