Inside the Apple LaserWriter

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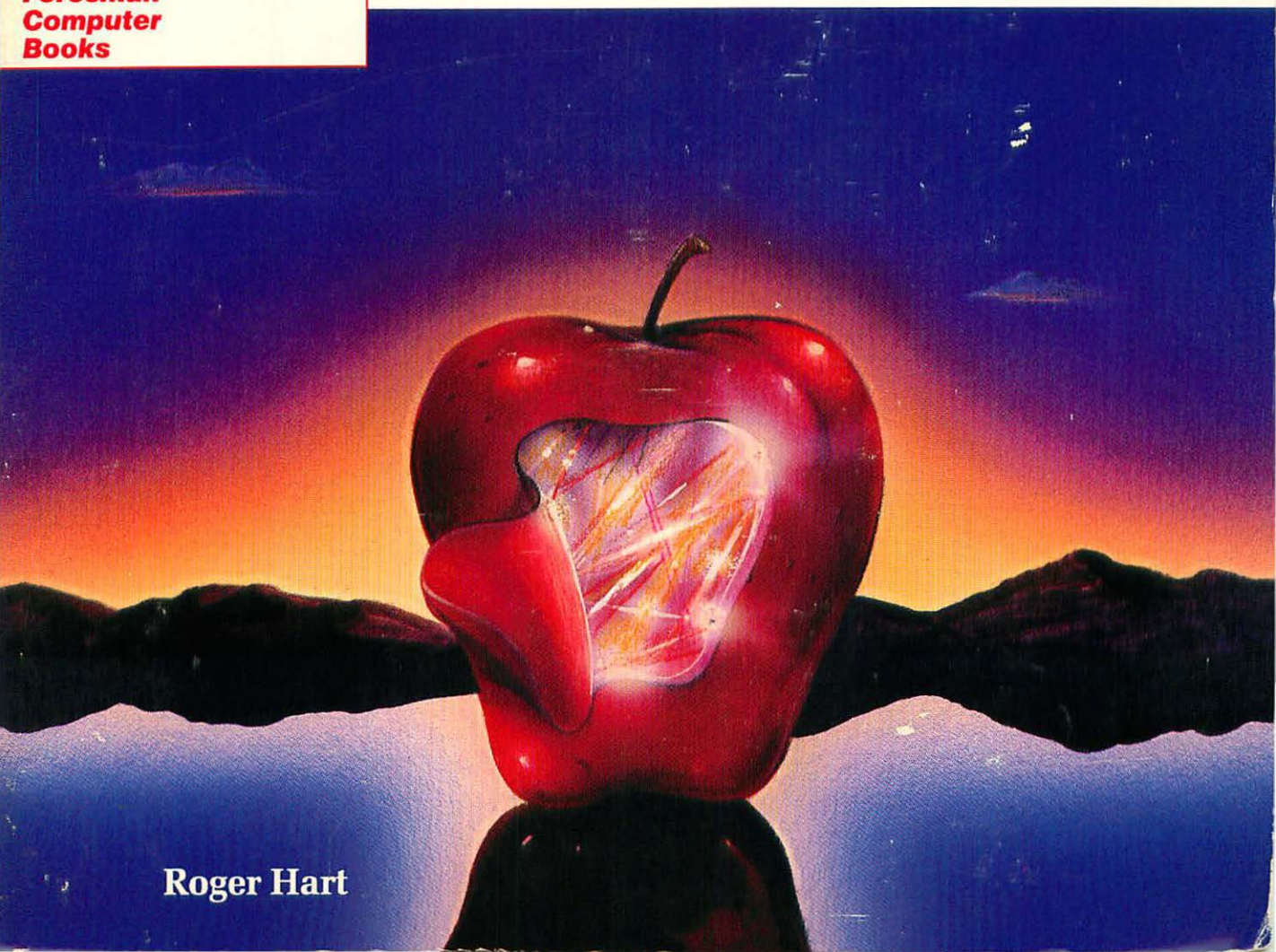

Roger Hart

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Preface

Printers may seem simple, but there's a lot lurking inside that we never see. This is especially true of PostScript printers like Apple's LaserWriters.

You're probably used to thinking about how powerful your computer is, how much memory it has and how fast its microprocessor is. Well, chances are that the LaserWriter is even more powerful and has more memory, a state-of-the-art microprocessor, and a built-in computer language for handling complex text and graphics. That's why there can be an entire book about these wonderfully useful printers. Yet most of the time, we tend to take a rather cavalier attitude and say, "Who cares? It works and that's all I want."

But what a shame such an attitude would be. The LaserWriters and their PostScript cousins are an extremely rich printing environment, much of which can be reached by the average user. That's what this book is all about: getting the most and the best from your LaserWriter or other PostScript printer. It's for people who care about how their work looks, and no other printer will make you and your work look as good.

I'm a business user of the LaserWriter, and it's people like me who should have this book. It is written for the average office and desktop publishing user, perhaps one who hasn't even invested in a laser printer yet. If you're still looking around before you invest in one, this book is also for you. You may end up deciding not to buy a PostScript printer. If so, you've still invested wisely in this book. If you do decide to buy a LaserWriter or other PostScript printer after reading this, you've made an excellent investment in the right printer purchase, and this book will help you use your new laser printer.

What this book is *not* is a programmer's guide or a hacker's book. There are good books, I'm sure, for such people, but what you'll find here in each

chapter are important topics that business and academic users can draw upon to enhance their application of this printer's wonderful features.

If it sounds like I'm a LaserWriter fanatic, well... I'm probably too mature to be blindly swept off my feet, but I've seen the richness of this printer and the promise that it holds, not just for experts, but for you and me, the average users who want superb text and graphics. This machine will do it all.

That's one of the things about PostScript printers. Their capabilities are almost limitless. If you're thinking about buying a laser printer and don't know whether or not to go to a PostScript model like the LaserWriter II NT, you will gain a lot of insight by reading this book. A LaserWriter is a must if you plan to enter the booming desktop publishing field.

Yes, other laser printers will give you some control over the appearance of your publications, but a LaserWriter will handle just about anything you could ever want to include, even halftones, unlimited typestyles and type sizes, and the ability to use the same file to generate high-quality typeset printing masters easily. That's real desktop publishing.

Remember, desktop publishing and presentations are an output-intensive application. This means that much depends on your printer, which is not the place to stint or save money. Conversely, it is the place where the pros will spend extra because they know that they'll eventually need PostScript printing's maximum power and excellence of output.

What if you're already convinced and have a LaserWriter Plus, NT, or AST TurboLaser/PS hooked up to your Macintosh or IBM-PC? Well, you've made a big investment in great technology. This book will help you protect that investment and get even more out of it. If you learn even one tip or new program that helps you do what you want your LaserWriter to do, then owning this book has paid off.

Before you plunge in, here are a few suggestions. First, I would urge you to read the entire book. Let me be even more specific: You should even read Chapter Eleven about using the PostScript programming language with your LaserWriter. I'm not a programmer; I'm a business user, but I know something about PostScript because it's interesting and it's useful even for the average user. There are programs that you can use that will simplify working with PostScript, and many are quite easy to use. The effects you can create can be quite stunning. So don't think the chapter about PostScript isn't for you; it is.

Second, I hope this book will help you solve any problems that may arise as you use your LaserWriter, but don't use it just as a problem-solving guide. There are a great many tips, suggestions, and hardware and software packages described throughout this book that can greatly enhance your use of a LaserWriter.

Here's what you'll find inside. First, there's a description of how laser printers work. No, they don't burn the image into the paper; they work by another, even more fascinating method. There's a discussion of how PostScript laser printers work and why they are different and more expensive, and better. We'll describe how to best hook up your LaserWriter, no matter what kind of system you have, and how to have one LaserWriter serve a great many computers, even different makes and models. Next come the practical matters of fonts and what they are, downloading new fonts, where to buy them, and how to make your text look even better. We'll look at graphics. Even though this is a large and complex subject, you'll be able to understand which graphics types are better and how to best use them all. Text and graphics get wrapped all together in Chapter Nine, where we cover publishing with your LaserWriter.

We'll also look into a few of the familiar and a great many of the less familiar programs that work with the LaserWriter. You'll probably read about some that you didn't even know existed. Chapter Ten is a good resource even if you're an old Mac/LaserWriter user. If you're using a system other than a Macintosh, be sure to read this chapter. There'll be software that you'll want to add to your collection.

A gentle look at PostScript, what it is and how you can use it, comes next. Don't miss it, either. PostScript can be lots of fun and will create some absolutely marvelous effects. You'll begin to see that most of your regular software really doesn't tap the incredible richness of PostScript's possibilities.

We'll look at Apple's non-PostScript entry-level printer, too. The LaserWriter II SC offers a lot of functionality for the money, and you can always upgrade it to PostScript and enjoy the rest of the book.

I really didn't plan on numbering the troubleshooting chapter thirteen. I'm not superstitious; it just worked out best there. You may never have any real problem with your LaserWriter (especially if you keep it clean), but if you do, look at this chapter before you call your dealer for service. Because there is a great deal of functional similarity to every PostScript printer, you'll also see a chapter that describes all the various PostScript printers and conversion kits that are on the market at the time of publication.

Finally, this book will help you locate useful products to use with your LaserWriter. There are literally hundreds, and there are no doubt quite a few that will help you in your specific kind of work. There's a glossary in the back of the book to explain the "techie" words, both the computer terms and those used in publishing and typography.

If this book helps you get more and better work from your LaserWriter, then we have both accomplished what this book intends.

Acknowledgments

Over the course of a lifetime, a person travels his own particular journey, and he's assisted in big and little ways by an almost countless number of people. Like most of us, I am particularly indebted to my mother, who always encouraged me to read and to learn. She even took my first book seriously when, nine years old, I showed her the handwritten pages. Though my mother is gone, I still have the dog-eared and yellowed manuscript covered with the unsteady pencil marks of my youth.

The greatest encouragement, in both my ability and my desire to write came, not surprisingly, from a teacher. Father Kammer not only taught me how to write well, but he also instilled in me the desire to write. He was a tough teacher; after all, he wrote the English textbook we used in that high school class years ago. He graded our compositions as thoroughly as he taught his lessons, too. I still have a theme paper covered with comments, suggestions, encouragements, and a multitude of page references to his textbook. He knew the book page by page and paragraph by paragraph. What a teacher!

Writing has thus always been an important part of my life. I have written a book and published many papers and articles in my field of business. Some of them have even won awards. Then, in the early 1980s, I began to write about a new fascination of mine, personal computers. Much of what I have written for magazines such as *InfoWorld, Publish!, Macintosh Buyer's Guide, Lotus Magazine, Home Office Computing, COMPAQ, Hardcopy, The Office, Office Systems, Modern Office Technology,* and *PC Resource* has been about printers. They may not seem exciting to some, but printers *make* the output, and the new ones, like Apple's LaserWriters, make wonderful pages.

So, that's how I came to write a book about laser printers. And I've had a lot of help. I want to thank the various people at Apple Computer who have provided clarification when things seemed confused, in particular Martha Steffen and Doug Sleeter for their help and trust during the project. Thanks also to all the vendors who graciously supplied details and, in some cases, copies of their software. They helped.

No book ever gets published without an editor, and I consider myself fortunate to have Amy Davis as my editor at Scott, Foresman & Co. She is patient and supportive, two qualities of unsurpassed importance to the task of getting a book published.

Patience is also a quality of a magazine editor who took care to be understanding when one of his contributing editors was also busy writing a book. To Nick Sullivan, senior editor of *Home Office Computing*, formerly known as *Family Computing*, my thanks.

Truthfully, this book would probably never have been written without the support, enouragement, and understanding of my wife Ann. It's nice to have someone at your side who believes in you, and that's her main contribution.

That's far from all, however. Her careful filing of odd bits of LaserWriter information, lore, and tips kept things where they could be found when needed, and her excellent editing should be appreciated by every reader. She spotted the problems rather than leaving them for you. You should thank her, too.

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Why Should You Be Using a LaserWriter?

We're going to take an intimate look at Apple's LaserWriter printers, but before we begin, keep in mind that your LaserWriter isn't just another laser printer. Laser printers are a technology for printing, and it's pretty high technology. Comparing the LaserWriters to Hewlett-Packard's LaserJet II is about the same as comparing a Pontiac Fiero to a Maserati. They're both sports cars but my, oh my, what a difference!

Apple's current line of laser printers is divided into two categories: QuickDraw-based and PostScript-based. We'll look at the QuickDraw laser printer, the LaserWriter IISC, in Chapter Twelve. For the rest of the book, however, we'll generally be discussing the PostScript machines—Apple's original LaserWriter, the LaserWriter Plus, and their latest offerings, the LaserWriter IINT and NTX. These are the PostScript laser printers, and they provide the richest environment you can buy for printing from a personal computer. They're the ultimate desktop printer.

These LaserWriters are really desktop "imagesetters," which is what really sets them apart. They produce full pages of high quality graphics, and page after page of excellent type fonts in practically any size you want. There's almost no limit to what a LaserWriter can do.

Don't think of them as just laser printers. They really belong to another category. If you're going to have the full power of today's desktop publishing revolution, look closely at these laser printers from Apple, even if you aren't going to use a Macintosh. If you decide on another kind of laser printer, you're settling for a distant second best. We'll be examining in easy-to-understand terms the many technical reasons why this is the case. We'll also discuss how you can get the very best from the LaserWriters.

Laser printers aren't as new as you might think; they've been around for over ten years. The reason most of us didn't have our hands on one was cost; they were the high speed laser printers connected to mainframe computers, they served mainly to spew out reams of text and numbers, and they cost at least $100,000.

Well, that's all changed now. For just a couple thousand dollars you can have laser printing too. And the quality is impressive. Oh, they're not cheap, but remember, letter-quality daisy wheel printers were at least $2,000 only a few years ago. That's not meant to hint that in the future laser printers will be like many daisy wheel models today, costing under $1,000.

No, desktop laser printers won't ever get much under $1,500, and that's for the "stripped-down" models, too. We'll be looking at Apple's Laser-

Writers, packed with power and full of professional publishing features just waiting for you to use. They're actually mini-typesetters capable of "imagesetting" graphics along with the text.

First, though, before we look at what sets the LaserWriter apart from its lesser brethren, it's worthwhile knowing more about laser printers and why they're so popular.

Lasers Make Their Mark

Printers were never the high-tech part of the computer system, until laser printers came along. Traditionally, printers have been noisy, rather "low tech" devices that served their purpose rather mundanely, albeit reliably.

Sit back for a moment and let your wishes come to the surface. Just what would you like in a computer printer if you could have anything you want?

If you set out to design the perfect printer to hook into your computer, you'd probably start with a daisy wheel's letter-quality text. It's very sharp and clear—just right for business correspondence. However, you'd be stuck with only one typestyle and type size for each document and a very limited ability to add enhancement or emphasis to your words. Just about all you would have is the ability to underline and print words in doublestrike to make it look bold—no italics and no change of typestyle or size. The print would be quite readable, but rather dull.

So, your perfect printer would let you change both size and style. The ability to mix typestyles and add enhancement and emphasis by using italics, boldface, and a variety of typefaces and sizes would allow you to create almost any kind of document, from a standard business letter to complex catalog layouts you get from your printshop.

You still wouldn't have one important feature that even the lowliest dot matrix printer has—the ability to add graphics to your work. A picture may be worth a thousand words, but daisy wheel printers aren't going to supply this value.

Remember, though, that we're dreaming about the perfect printer for your computer. It would, of course, do graphics in beautiful quality. You would be able to mix charts, drawings, and graphs—in short, all manner of graphics, as much of them as you want and anywhere on the page.

Furthermore, it would be "whisper-quiet." If we're designing the ultimate printer, we'd leave out the noise we've had to put up with from those dot matrix and daisy wheel models. No more banging and buzzing. This printer could sit right next to your telephone if you wanted.

And it would be fast. Hundreds and hundreds of characters per second.

Well, that's today's desktop laser printer. It handles text in a variety of fonts, styles, sizes, and enhancements. You get beautiful graphics, too. Both text

and graphics look almost as good as typeset material. This is truly the professional printing machine for your computer.

Finally, printer technology is in a class equal to the technology of today's computers.

Now you can see why sales of desktop laser printers are the fastest growing sales of any kind of printer. They simply do it all in a print quality that sets new standards. Laser printing isn't quite as good as professional typesetting, but it's close—so close that you'll often be using laser printouts as printing masters, rather than having a lot of material sent out for typesetting.

For years you've had a super, space-age computer hooked up to a printer that uses yesterday's technology. After all, dot matrix and daisy wheel printers simply bang the image into the paper with hammers. That's not really high tech, is it? This has changed forever with the new laser printers. They bring printing technology to the same cutting edge that exists deep inside your computer's microprocessor. And Apple has packed more modern technology into its LaserWriters than anyone else.

Apple's Power-packed Performance

Laser printers make correspondence and reports look great, but you haven't seen anything until you start using a LaserWriter. Oh, you can "tune it down" to act just like a Diablo 630 daisy wheel, but that's like keeping a Ferrari under twenty. It wants to rev up.

The LaserWriter isn't any faster than simpler laser printers like Hewlett-Packard's LaserJet series. They are both rated at eight pages per minute. No, rather than just giving you raw speed, you get built-in features that make the LaserWriter a whole new class of printer. It really can't be compared with more ordinary types of laser printers.

Apple's LaserWriter design team took advantage of several fast-breaking technological developments—all for your benefit. After all, they had the basic Macintosh system design to work with. It may seem like a cute little computer, but the Macintosh incorporates a great many state-of-the-art developments that are just now being implemented on other systems, like IBM's PS/2 models, and many will argue that IBM's implementation still falls short of the 1984 Macintosh design.

Part of understanding the LaserWriter's sophistication is getting a good feel for what makes the Mac special. And it's not always a question of things that are obvious. The clean graphic interface, pull-down menus, and mouse cursor controller are apparent to all, but hidden away inside the innocent-looking case is a powerful microprocessor connected to ROM (read-only memory) chips containing special graphics routines that save time and keep software looking the same, no matter which package you're using. In large part this is because software developers use the prepackaged, built-in instructions and

routines that Apple designed into the Macintosh. If Apple had just put it all in as software, the Mac would likely have far less consistency from one software program to another.

A Smart Printer for a Smart Computer

What you may well have missed about the Macintosh system, however, is its intelligence. The Mac may look cuddly and inviting, but it's smart, too. It knows when something is attached to it. Peripherals, including the LaserWriter and disk drives, communicate with the Mac. Your Mac not only knows when the LaserWriter is connected, it also knows if the printer is turned on. It even knows what the LaserWriter is currently doing.

In designing a laser printer for the system, Apple kept the Macintosh approach to mixing fonts, type sizes, and graphics, added the ability to fill an entire page with graphics (you'll soon see why graphics are, traditionally, the most difficult item to print on a laser printer), and then added a new computer language, PostScript, just previously developed by Adobe Systems in nearby Palo Alto.

The groundbreaking design of Apple's Macintosh computer really led the way for their LaserWriter. After all, could the company that brought you MacPaint offer you a printer that wouldn't print graphics? And a full page at a time, if that's what you want.

When the LaserWriter was originally introduced in 1985, it was the only laser printer that could print a full page of high quality graphics (Figure 1.1). Other entries were limited to small areas, unless you were satisfied with larger areas filled with graphics of rather coarse quality.

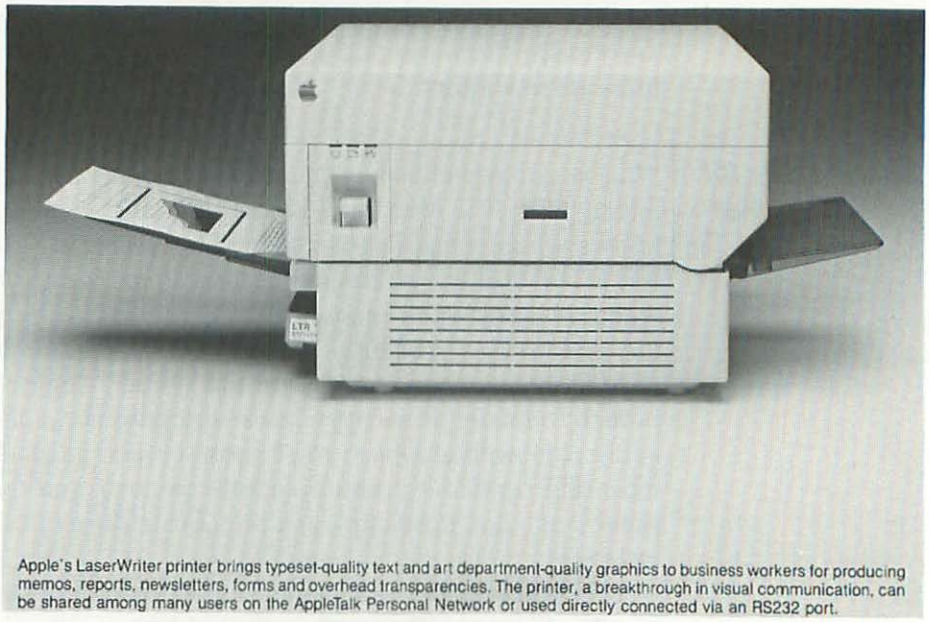
The LaserWriters will print an entire page of graphics at their full printing quality, a resolution of 300 dots per inch. Other, lower priced competitors had to drop their print quality down to 75 dots per inch when you went to full-page graphics which is about what a draft-quality dot matrix printer will do. This hardly makes "going laser" worthwhile for doing graphics.

You even get some built-in smoothing routines with the LaserWriter that improve the print quality for files created with bit-mapped graphics, like MacPaint's, comprised of dots.

In addition, Apple designers built in the ability to hook more than one computer to their LaserWriter. Laser printers are expensive, especially when you have to have a printer for each user. The multi-user capability built into every LaserWriter, LaserWriter Plus and LaserWriter II NT and NTX makes them a very economical choice for office work groups.

The PostScript Difference

PostScript printers like the LaserWriter are not just ordinary laser printers. Here's a side-by-side comparison of the general features of PostScript printers with regular office laser printers.



Apple's LaserWriter printer brings typeset-quality text and art department-quality graphics to business workers for producing memos, reports, newsletters, forms and overhead transparencies. The printer, a breakthrough in visual communication, can be shared among many users on the AppleTalk Personal Network or used directly connected via an RS232 port.

Figure 1.1. Photo of original LaserWriter: Apple's breakthrough laser printer, the LaserWriter, introduced in 1985 and hailed by many as "product of the year."

PostScript	*non-PostScript*
Fonts are stored in printer's memory	Fonts are stored in computer or font cartridge
Large number of fonts per page	Small number of fonts per page
Fonts are professional typesetting designs	Fonts are often nonstandard designs
Font sizes are unlimited	Font sizes are quite limited and memory intensive
Special type effects (rotation, skewing, slanting, etc.)	Few, if any, special type effects
Easily used by multiple computers	Generally used by only one computer
Easy to send to typesetters	Impossible or difficult to send to typesetters
Excellent control of graphics	Limited graphics ability

So, in essence, the possibilities now available to you with your LaserWriter go far beyond what most desktop laser printers like QMS's KISS and Hewlett-Packard's LaserJet models can do. With your LaserWriter you can become your own publisher.

Designed for Publishing

If you're interested in knowing more about the LaserWriter, you are likely to have an interest in desktop publishing, which become the fastest growing new application for computers, joining the ranks of the four old "favorites"—word processing, spreadsheets, data bases, and graphics. Now, there's a fifth major personal computer application, and your LaserWriter is poised for the desktop publishing revolution.

Basically, there are two reasons why the Apple LaserWriter fits into desktop publishing so well, beyond the fact that it works with the Macintosh, which is quite well suited for this highly graphic application. First, regardless of the computer you use, the LaserWriter has enough memory to handle large areas of high quality graphics. Second, it has the new PostScript language, which adds real publishing power because it allows you to use the same typefaces that professional typesetters use—fonts like Times Roman, Helvetica, Century Schoolbook, Palatino, and others. PostScript also has the power to place different elements precisely on the page and to have them print out exactly right. PostScript can do magical things with type—rotate it, slant it, fill it with patterns, and run it around in circles. Almost anything you can think of can be done using PostScript. I can even print the same file on a LaserWriter or a super high quality phototypesetter for the most demanding jobs.

Don't worry about PostScript being a computer language; you don't have to learn anything about it if you don't want to. The power of PostScript is deep inside your LaserWriter, where your computer and its software can use its power to produce documents that, prior to all this new technology, you could only get from a design and layout artist with access to a typesetting machine.

In a later chapter, we will talk about actually using PostScript to create special effects like the one shown in Figure 1.2, which was produced by making a very minor change in a readily available public domain PostScript file. It's so simple that anyone can do it. The real point is this: Can your typical office laser printer curve text like this? It may seem simple, but it takes lots of power to do.

The LaserWriters are designed for publishing—especially the NTX. This member of the LaserWriter II family (Figure 1.3) has room to expand the

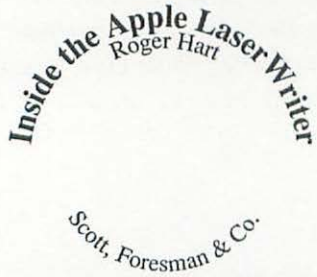


Figure 1.2. Circle of text showing book's title, etc.: PostScript, from Adobe Systems, allows you to create visual effects with type by using simple commands.

amount of internal memory and the capability to add a hard disk to store as many fonts as you wish. It's the ideal printer for a publishing group.

If you think of your computer and its software as the mind and imagination of a graphic artist, the LaserWriter becomes the drawing board, pens, razor knives, scissors, rules, and paste pot to put it all together in final form.

The Apple® LaserWriter® II family of modular laser printers offers Macintosh® computer users an easy and cost-effective method of upgrading as their printer needs grow. The family--consisting of the entry level LaserWriter IISC, the mainstream LaserWriter IINT, and the high performance LaserWriter IINTX--is capable of handling a range of actvities from general office productivity to desktop publishing to high-end volume printing.

Figure 1.3. Photo of LaserWriter II: Apple's newest laser printers are the LaserWriter II Series.

Examining Cost and Capability

Of all the desktop laser printers on the market, Apple's PostScript LaserWriters are among the most expensive. Yet, they're a bargain when you consider the features you are getting for the money, especially if your interest is publishing or presentation graphics.

How the Others Do It

There certainly are cheaper laser printers on the market. The LaserJet Series II or QMS KISS can be bought for a little less than $2,000, but these models are really just laser equivalents of daisy wheel printers. They aren't able to handle a wide variety of typestyles or type sizes and are limited in the amount of graphics they can print in high quality.

You can buy one of the inexpensive printers and upgrade it to have approximately the same functionality as a LaserWriter. If you buy a QMS KISS printer, for example, and add to it a PSJet PostScript memory board from The Laser Connection, you'll spend somewhat more money than a LaserWriter II NT costs, but with the LaserWriter II NT, there's no modification needed; you just plug it in and it runs.

Modifying a cheaper printer into a PostScript publishing printer with the same performance as the LaserWriter turns out to be more expensive.

There are other PostScript laser printers, too. What about them? IBM's Personal Pageprinter is a PostScript-compatible laser printer that has most of the functional printing capability of Apple's LaserWriters. However, it's designed to be used by a single user. You have to buy one for each and every user—a very costly and needlessly expensive disadvantage. The Apple LaserWriters, on the other hand, are easily connected to multiple computers, thus bringing the per user cost down dramatically, which is a clearcut cost performance advantage for Apple's product.

IBM's Personal PagePrinter uses a different approach to keeping the data transfer times between computer and printer down to a reasonable amount. The IBM printer's memory, microprocessor, and PostScript interpreter are on a card placed in one of the slots in the back of the PC. This is done because the PostScript file is converted to a video format that is transmitted at much higher speeds than serial or parallel data. This sounds fine as long as you have only one computer and one laser printer, but this arrangement does not allow the sharing of the printer with other computers. Each one must have its own printer. Hence the name, *Personal* PagePrinter. They mean "personal."

Yet IBM's PostScript printer costs as much as (actually, even more than) Apple's PostScript LaserWriter. This means that the cost per user for IBM's PostScript printer is four to five thousand dollars, compared with five hundred dollars per user when ten computers are attached to a single LaserWriter.

Here's Apple's Approach

Let's take a closer look at why the LaserWriter costs what it does. To begin with, there are the basic laser printer insides, called the "engine." The one Apple uses for the LaserWriter II models is made by the Japanese firm, Canon, who sells the very same engine to Hewlett-Packard for their LaserJet II series and to QMS for their KISS-plus printers. Even the stripped-down versions of these printers cost around two thousand dollars.

In addition, the LaserWriter contains the basic workings of a computer—Motorola's 68000 microprocessor, the same powerful computer chip that makes the Macintosh work. This computer chip runs the PostScript program and calculates all the various sizes of typefaces your document requires. These calculations are done fast, too—even faster than your Mac can do them. The LaserWriter's computer chip runs fifty percent faster than the same chip put into the Macintosh Plus and SE. But there's even more. The new LaserWriter NTX is even faster. It contains the speed demon Motorola 68020 chip that powers the Mac II.

Apple then adds memory—lots of memory. Right out of the box, the LaserWriter has twice as much memory as Apple's awesome Macintosh II. The original LaserWriter printers contained 1,500K (1.5 megabytes) of random access memory (RAM). The NT and NTX printers have even more memory—2 megabytes. And the NTX can be easily expanded up to 12 megabytes.

Furthermore, there's a load of permanent memory chips inside the LaserWriter—another 500K in the original model and 1 megabyte in the LaserWriter Plus and LaserWriter II series. These are the ROM chips that hold the PostScript language and all the typeface designs that come built-in.

The original LaserWriter came with four built-in typefaces. Two are professional publishing typestyles, Times Roman and Helvetica. The third is Courier, a font designed to look like a typewriter, and the fourth is Symbol, a collection of Greek scientific and mathematical characters and line and box graphic elements.

The LaserWriter Plus and LaserWriter II NT and NTX hold even more. You'll have 1,000K crammed full of the popular publishing typefaces—Helvetica Narrow, Palatino, ITC Avant Garde, ITC Bookman, ITC Zapf Chancery, New Century Schoolbook, and ITC Zapf Dingbats. The latter is a collection of special decorative characters used for adding "zing" to your documents. All of these are professional typesetting fonts licensed from their original designers. You're buying the real thing, not a "close" imitation.

Apple's design team also greatly speeded up the way the computer "talks" to the laser printer. You see, when you're set to print lots of graphics, all that information has to be sent to the printer, and it can be literally millions and millions of bits of information. A full page of graphics can have over six million dots on a page. All this has to be done exactly, too. If you look around

at many of the other laser printers on the market, you'll find that some have real problems printing graphics.

Your computer has to tell a laser printer, any laser printer, exactly where to place each and every dot. That's lots of information to send. To make it faster than the common serial or parallel connections, Apple designed the LocalTalk (formerly called AppleTalk) network, a high speed cable to hook up your LaserWriter with one or more computers—as many as fifty in all.

So, if you've wondered why the LaserWriters are more expensive than a lot of other laser printers on the market, those are the reasons—all good reasons. They make the Apple LaserWriters the most cost-effective desktop publishing laser printers on the market. The LaserWriters really do give you a lot for your money.

Why Should You Be Using a LaserWriter?

If you have a Macintosh computer, the LaserWriter is the ultimate printing machine. Beautiful text printed in sizes from large to small can be mixed with graphics of all kinds, including bit-mapped graphics made up of dots from programs like MacPaint, Ann Arbor's FullPaint, or graphics from object-oriented programs that use mathematical descriptions of the design, such as MacDraw or Adobe's Illustrator.

In short, all of the "gee-whiz" stuff you can do on the Mac can be printed out in a beautiful, high resolution that most people can't readily distinguish from typesetting.

If you've taken your Macintosh into the realm of desktop publishing, then the LaserWriters are the perfect match. You'll be proud of the exquisite work coming out the laser end of the system. It's good enough to be used as a master for reproduction by photo offset printing.

And If You're a PC User?

What if you're one of those people with that other kind of computer?

If plain reports and correspondence are all you're ever going to do, it really doesn't make sense to invest in a LaserWriter or other PostScript printer. You're better off with a good text printing laser machine like the LaserJet II or KISS-plus. But what about those of you (and there are a great many) who want to use your IBM-PC, compatible, Apple II, Atari ST, or Amiga for graphics or desktop publishing? In their price range, there are no other laser printers that pack more publishing power than the PostScript laser printers like Apple's LaserWriters. No, you don't have to have a Macintosh; thousands of people are using LaserWriters with their IBM-PCs right now—this very minute. And for good reason: Desktop publishing software developers recognize the

power of PostScript printers like the LaserWriters to produce the ultimate professional-looking laser-typeset documents.

With the LaserWriter's PostScript behind you, you can take the same document file, send it to a PostScript-compatible Linotronic 100 or 300 phototypesetter, and get out a camera-ready image in ultra-high quality with a resolution of up to 2,450 dots per inch—graphics and text combined. You don't have to worry about pasting graphics and type together. You combine them in the computer and then typeset the entire layout image in one complete operation. This is a tremendous breakthrough in publishing. Now you can typeset the entire layout. That's why PostScript typesetters are being called "imagesetters."

Apple's LaserWriters have this PostScript advantage. Most desktop publishing software packages are written to work with several makes of laser printers, but the best type quality and the greatest number of allowable features will be available when you print your layouts from a PostScript printer like the LaserWriters. (See Chapter Ten for a description of a number of software programs compatible with the Apple LaserWriters.)

There are highly technical reasons why the LaserWriter will produce text fonts more faithfully that the Hewlett-Packard LaserJet II Series printers, but all you have to do to become a believer is to run the IBM version of Aldus' PageMaker on each printer. In fact, if you're debating which to buy, be sure to run PageMaker, or some other Windows application, on both lasers.

With the LaserWriter, PageMaker will automatically look to see what fonts are available, including downloadable ones, and configure itself to have them available for use during your page layout session. Using PageMaker with the LaserJet, however, you must install each font size and style by carefully typing in command codes. After this, each font, size, and style must be separately converted with PageMaker's PCLPFM utility, and then carefully and painstakingly added to the Windows' WIN.INI configuration file—a long and tedious job. LaserWriter users are truly fortunate, aren't they?

If you're using page layout or illustration software that produces a PostScript format on an IBM-PC, the LaserWriters will produce highly elaborate graphics and text effects that lesser printers can't begin to approach.

Seeing is believing. Compare the laser output from a PC-based publishing program using a Hewlett-Packard LaserJet II with that from an Apple LaserWriter. You'll see why desktop publishers, regardless of the computer they use, are buying Apple's publishing powerhouse LaserWriters with the PostScript advantage.

It's Nice to Share

The LaserWriters also have the AppleTalk advantage. More than thirty computers—PCs or Macs—can use a single LaserWriter. Sharing a laser printer in this manner brings the cost per user down dramatically. This is why there

are more AppleTalk networks in use today than any other type. It offers maximum publishing power at a minimum cost. And it's all built into your LaserWriter.

The Apple LaserWriters, when compared feature by feature, are the most economical desktop publishing laser printers on the market. And they are designed to be just right for what you need. If you're starting out and don't want to invest quite as much money, there's the SC. Read more about it in Chapter Twelve. It's a great printer for the money.

Further up the price and performance scale comes the LaserWriter II NT. Lots of people can share one, its got plenty of memory for most uses, and it's got PostScript. If you need even more, there's the NTX. It's hard to imagine running out of this printer's capabilities. Just keep expanding it. Add more memory and even a hard disk to store fonts online. This one is designed for heavy publishing groups.

Whatever your needs, there's a LaserWriter for you.

CHAPTER **TWO**

Laser Basics

Photocopier with Brains

Going from Light to Dark

How Fonts Are Handled—Bit-mapped Versus Scaled

Memory—How Much and Why

Graphics—One Bit at a Time

Connectability (What about IBM?)

Laser printers aren't new, but in the past they were terribly expensive. You would never think of having your own—not for over $100,000 apiece!

Virtually every laser printer, even the big expensive ones, contains the insides of a xerographic photocopier. It's not surprising, then, that many of the big mainframe laser printers have been made by Xerox Corporation.

Early laser printers were built for speed. Like their high speed photocopier cousins, they were and still are expensive. The desktop laser printer—one that could serve as a personal or small office group printer—had to wait until photocopier technology became cheap enough for the inner xerographic printing mechanism, the engine, to be modified into a small laser printer.

This is just what happened when Canon, the Japanese camera giant, introduced its line of tabletop photocopiers. Reasonable in price, some were even under $1,000, a real price breakthrough. To sell at such prices, Canon had to do things differently.

Traditionally, photocopiers relied on forming their image on a carefully made, highly polished drum coated with a rare and expensive element, selenium. These selenium drums, in addition to being very expensive, were subject to damage and have been a troublesome component. Repairs and replacements add greatly to the cost of operating a standard selenium drum photocopier. Canon, however, solved the problem by developing a special polymer as the image former to replace the expensive, troublesome selenium. This polymer was cheap enough to be used in manufacturing small photocopiers and also alleviated the pesky problem of large photocopiers—downtime for repair or replacement of the imaging drum. Now, you could throw away the imaging unit before its performance deteriorated or it began to cause mechanical or imaging problems.

Canon's low-cost, replaceable element approach put inexpensive photocopiers into offices worldwide. As Canon sold more and more of them, they became cheaper to manufacture. The internal engines subsequently became inexpensive enough to use in manufacturing desktop laser printers. The paper handling and imaging mechanism was well-suited to the development of a low-cost, reliable laser printer small enough to sit next to a desktop computer.

Photocopier with Brains

In the early 1980s, Canon approached a number of U.S. computer and printer manufacturers to see if they would be interested in producing a small, office-sized laser printer using its engine. Canon had developed this engine direct-

ly from its own photocopier experience and had designed a laser light source for "marking" the image on the imaging surface.

Thus the Canon LBP-CX marking engine became the central mechanism around which all the early desktop laser printers were designed. This includes the original Hewlett-Packard LaserJets and Apple LaserWriters. They shared the same basic internal working parts. Today, they still share the same basic insides—Canon's LBP-SX, a much improved, low-profile design.

What Canon didn't supply, however, was a way to get computer information into the printer and convert it into a form usable by the laser. This conversion of computer bits to a form of information the laser can "shoot" is an important consideration. Simply put, the computer information comes into the laser printer as data bits, those series of ones and zeros that most of us have heard about but don't really want to deal with directly. This bit data has to be changed to a back-and-forth "scan" that the laser light "writes" on the light-sensitive, image-forming area. The image is actually "painted" with light onto the photosensitive drum as the laser fires. This back-and-forth or "raster" scanning is similar to the way the picture is "written" onto your television screen.

With television, the data is in the form of high frequency waves that come in through the antenna and are converted into a back-and-forth sweep scan that produces the lines on the picture tube. Laser printers work basically the same way. The information has to be "translated" into a back-and-forth sweep before it can be printed.

A Light of a Different Kind

Let's stop for a minute and consider the laser itself. The term "laser" stands for *light amplification by stimulated emission of radiation,* which, for most people, means nothing. A laser is a source of light that is different from just about every other light source you've ever used.

Shine a flashlight across a room, and you'll notice that the spot of light on the wall is bigger than the beam from the lens. It spreads out as it travels away from you. The light beam diverges or gets larger as it emanates. This is typical of the way virtually every source of light works, including the sun itself.

What makes the light from a laser so special is that it stays "put together" in a straight beam. Laser light is coherent, not divergent. You can shine a laser light beam from the earth to the moon, and when it hits the moon, it's still a small pinpoint of light. In addition, you can control the exact amount of light energy in the beam. Laser light is very, very precise and can be carefully and accurately controlled, which is a key feature that makes the whole idea of a laser printer work. It fires a beam of light so small and accurate that it can put 90,000 dots of light in a single square inch! And it can do it fast—in only seconds.

In a laser printer, the laser itself is stationary; it doesn't move. A rotating mirror moves the laser light beam back and forth to produce the scan across the page (Figure 2.1).

It's easy to see why all this has to be carefully controlled. It's no wonder that the add-on device used to do this became known as the "controller" or "raster image processor" (RIP).

It Takes Control

This controller device is essential to making every laser printer work. Apple's controller has some extras, too. One of these extras is what sets the LaserWriters apart from most of the other laser printers on the market—PostScript. In short, PostScript takes the LaserWriters out of the plain, ordinary laser printer class and launches them into a totally new category—low cost typesetting and imagesetting machines for publishing.

When your file goes to the LaserWriter to be printed, it is in the form of PostScript and thus could be sent to any PostScript device, even an Allied Linotronic 300P phototypesetter.

Once inside the LaserWriter, however, the raster image processor converts the PostScript document into the back-and-forth raster sweep that "paints" a bit-mapped image on the photosensitive polymer surface.

So, if you're using a Macintosh with your LaserWriter, the data that you've typed in manually has undergone quite a few changes before the printed copy emerges from the printer.

You press a key on the Mac, which sends a piece of data signifying that particular key to the Motorola 68000 microprocessor. The Mac's read-only memory (ROM) converts the page that the character lands on into the Mac's special QuickDraw language, which is then converted into PostScript which, in turn, is changed inside the LaserWriter to a raster-scanned bit-map that makes the image that gets printed. Pretty amazing, isn't it? And you hardly know that all this is going on behind the scenes.

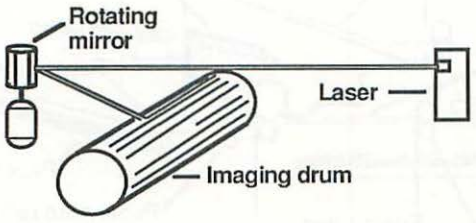


Figure 2.1. Diagram of rotating mirror: The laser beam is moved back and forth using an optical system and rotating mirror.

Going from Light to Dark

When the laser light beam hits the light sensitive polymer surface, things happen. The surface already has an electric charge on it, and wherever the light hits it, the charge is neutralized. The actual image that you want to print thus has a different charge than the rest of the surface.

From this stage on, the laser printer begins to look a lot like it's predecessor, the photocopier, which works in the same fashion. Once the light falls on the sensitive surface and sets up this electrically neutral area that matches the image, the surface is moved to contact a dry black powder called "toner." The toner is a very fine powder, which has the same kind of charge as the unexposed sensitive surface.

Lasers Reverse the Charges

One rule of nature is that opposites attract and like things repel. This works in laser printers and photocopiers, too. The areas that are not hit by the laser retain the same negative charge as the toner particles which are therefore repelled. They don't stick onto the blank, unexposed areas.

Where the laser strikes, a tiny dot of area is discharged. This allows the toner to be attracted and adhere. The toner thus forms a positive image of the piece to be printed.

Next, the toner-coated surface is contacted with a positively charged piece of paper onto which the toner particles transfer. This toner-coated paper then goes through heated rollers where the toner is pressed and melted or "fused" to the paper as a permanent black image (Figure 2.2).

This process simply works on the principle of electric charges, along with a powdered ink toner that is easily melted to the paper. The toner is a key component of the system and is one of the limiting factors in improving the resolution of laser printers above the 300 dot per inch level. The lasers can

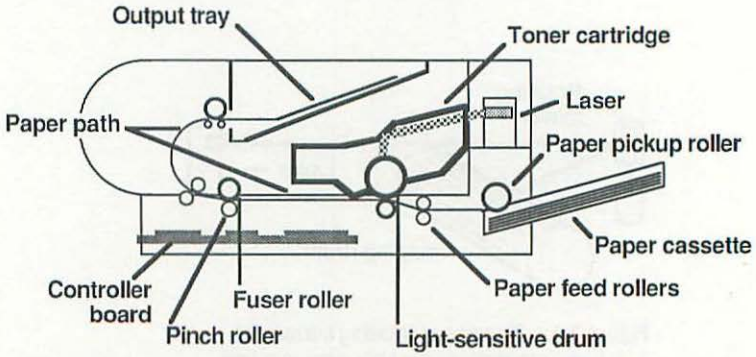


Figure 2.2. Diagram of LaserWriter II: A simplified look at the inner workings of the LaserWriter II.

do it, but the toner particles must be made much smaller in order to create higher dot densities.

The best current laser printer technology places 1200 by 600 dots per inch (720,000 dots in a single square inch!), but the toner particle size limits the effective dot size to about 700 dots per inch. Technically, however, toner chemistry could attain more than 1,000 dots per inch, which is good enough for most routine typesetting.

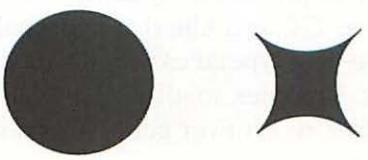
The Difference between Black and White

It is also possible to design a laser printer to make the toner stick where the beam of laser light has struck, or to design the system to have the toner stick to the areas untouched by the light beam. This is the difference between *write-white* and *write-black* laser printers.

Look at Figure 2.3 and you will see the difference in the general shape of the dots made by write-white and write-black printers; there is a significant difference in how each kind makes its respective images from the dots of light. The output from a write-white printer will never be identical to that from a write-black variety. Small objects (small typesizes, for example) will be cleaner and darker on write-black printers. The LaserWriters, by the way, are write-black printers.

Most of the imaging technology described above fits any laser printer. Let's now look at a feature of Apple's PostScript laser printer designed particularly for publishing, which makes a big difference in what comes out of the end of all this process.

In a later chapter we will examine in detail the printer-controlling language Apple chose to include in its LaserWriters, also called PostScript, but for now, we can look at one of the PostScript laser printer's principal features, the formation of clean, professional-looking typefaces—the same typefaces used in publishing books, magazines, and newspapers.



Write-black **Write-white**

Figure 2.3. The laser printing imaging method makes a small but noticeable difference in results.

How Fonts Are Handled—Bit-mapped versus Scaled

Laser printers form their images out of dots. The difference between a LaserJet or LaserWriter and the more familiar Epson MX-80 dot matrix printer lies in the greater number of dots possible with laser imaging. Lasers put as many as 90 thousand dots on a square inch of paper.

All laser printers (including the PostScript LaserWriters) make their characters—these letters, numbers and punctuation marks we use for expressing ourselves in writing—out of patterns of dots, just like the familiar dot matrix printers. Of course, you get more dots with a laser printer, but the idea is the same.

It's All Dots

In most laser printers, the shape of each character is made up of a pattern of dots carefully laid out. Each arc and curve of a capital letter, such as *S*, is constructed from an exact pattern of dots. This is how the H-P LaserJet creates text, for example, and it uses plug-in memory cartridges containing maps or digital diagrams of these dot patterns.

A single H-P LaserJet cartridge carries a limited number of typestyles and sizes. Font Cartridge 92286F, for example, contains a style similar to Times Roman, called Tms Rmn in 8- and 10-point size, as well as italic and bold versions for the 10-point size. In addition, there is a Helvetica look-alike called Helv in bold 14.4 point. All these are stored permanently in bit-mapped dot form.

Unless you resort to sending extra typestyles and sizes from your computer to the Hewlett-Packard LaserJet's internal memory, you're stuck with this very limited combination of sizes and styles. The LaserJet II printers can access two cartridges, but there is still a small choice of fonts and sizes.

Well, there's another way to create the intricate shapes of letters and numbers, which is to store a mathematical description of each character's shape. Sounds complicated though, doesn't it? Nevertheless, that's just what PostScript does for the Apple LaserWriters, and it makes a big difference. In fact, it's an enormous improvement.

Comes the Expandable Font

The developers of PostScript, Adobe Systems, have contracted with major type design firms such as ITC and Allied Merganthaler Linotype, to convert their professional publishing typefaces into PostScript form using complex mathematical formulas. Complex math is just what computers do best, of course, and you, the user, won't ever get involved in it directly. It all takes place behind the scenes.

Storing the typeface as a mathematical outline brings an important benefit to every user of a PostScript-equipped printing device, whether a laser printer like the Apple LaserWriters or a typesetter like the Allied Linotronic. PostScript typefaces are stored in a single size and are scaled to exactly the

size you need at the time you need it. Your software just tells PostScript that it needs an 18-point Helvetica Narrow letter *A* in bold underline, and PostScript creates the proper dot pattern in just that size and enhancement. Think about this for a moment. It's a key difference between ordinary laser printers and the Apple LaserWriters.

The LaserWriters create different type sizes from a single stored shape. You could just as easily ask for a 17-point size. If that doesn't suit your needs, choose 16-point. PostScript makes them to order just the way you want them.

Other laser printers must store or have available for downloading (more about that later) every size of typeface that your document will call for. If you have 18-point available in cartridge or disk and decide on 17-point to get the exact line length you want, you'll have to load the 17-point bit-map for the font into your printer first. And it's unlikely that there will be a 17-point size available.

This lack of ability to scale typefaces severely limits the average laser printer for desktop publishing. That's one of the reasons PostScript printers are so popular for desktop publishing, and that's why you should buy one if you plan on producing complex documents.

Furthermore, typefaces derived from PostScript are of very high quality, usually better looking than the bit-mapped kind. The type from a PostScript laser printer like the LaserWriter will be of higher quality and certainly far more diverse than the type from other laser printers. Having PostScript at your command means that you get documents in type that looks almost as good as professional typesetting and that comes in a wide variety of sizes and enhancements, which is a major advantage of your LaserWriter.

Memory—How Much and Why

The LaserWriters have even more memory than most of Apple's computers. The LaserWriter Plus and LaserWriter II models contain 1 megabyte of permanent ROM. These hold the built-in fonts and PostScript language interpreter. In addition, the LaserWriter Plus contains 1.5 megabytes of RAM, and the LaserWriter II models contain 2 megabytes of RAM, which is more than an off-the-shelf Macintosh II or IBM PS/80. There is, of course, a reason for all this memory.

Most printers, such as dot matrix and daisywheels, print one character or line at a time back and forth until the entire page is printed. Laser models are different; they print the entire page at one time, which means that the printer must have enough memory to store the amount of data required for an entire page. For pages that are all text and no graphics, the required memory isn't much. Laser printers like the QMS KISS and H-P LaserJet that are meant to be used mainly for printing business correspondence don't come with

much memory. They usually have just enough to handle a single page of text with little left over.

Even More Memory

Add graphics to your document, and you start to gobble up memory quickly with all the bits needed to make the image. This bogs down most lower cost laser printers, and all you get are error messages instead of output.

This is another reason that having memory available in a laser printer is handy, especially for desktop publishing. This particular computer application makes extreme demands on your computer system, especially the laser printer used to print out finished copies. Memory is required for graphics and for handling a variety of typefaces.

Apple's LaserWriters have several typefaces or fonts already built into their ROM chips, and they're the same professional publishing typefaces that are used to print books and newspapers. But what happens when you want to add a new face to the crowd? What if you want to use a typestyle that isn't already resident in the printer's permanent memory? This is where downloading comes in.

Your laser printer doesn't have to have every possible font that you might ever want to use. Other fonts can be held in your computer either on a floppy disk or hard disk. When printing a document having one of these non-resident fonts, you will send it ahead to the printer's memory, or the LaserWriter will look back toward the computer for it. The Laserwriter then has the computer send the font automatically to the printer's memory where it can be used to create the document.

In short, that's downloading. It simply allows you a much wider choice of fonts or typestyles to be used in your documents—many more than would be economical to store permanently in your laser printer's ROM.

Some of these fonts are quite special and very useful. Some are foreign language characters, and others are complex mathematical or chemical formulas. Examples and sources are given in Chapter Six.

Having memory inside your laser printer thus helps it store the page, including complex bit-mapped graphics, and receive any extra typestyles that are required for printing.

Graphics—One Bit at a Time

When it comes to printing graphics made up of dots, the so-called *bit-mapped* kind, laser printers have a hard time. They must store the location of every dot *before* any of the actual printing process begins. Therefore,

printing from a graphic application like MacPaint, PC Paint, or images input by optical scanners takes lots of memory.

Apple's LaserWriters have more than enough memory storage to print a full page of graphics. Contrast this with Hewlett-Packard's LaserJet Plus or Series II with only 512K memory capacity. They can handle only a half page of high quality graphics, leaving no memory left for downloaded fonts, which is perhaps all right for correspondence and simple desktop publishing, but it is a decided disadvantage for more complex tasks.

Of course, you can expand the memory of the LaserJet Plus and LaserJet II. All it takes is more money. You'll end up with a printer that costs more than the Apple LaserWriter IINT and still has less functionality and typographic versatility.

The Truth Is in the Sending

Bit-mapped graphics will also slow down the LaserWriter's printing process. This is true for any laser printer. It's not the actual printing that's slower, but the time it takes to send all that information from your Macintosh or other computer and to process the information once it's inside the LaserWriter.

Sending these large amounts of data isn't too slow if you are connected to your LaserWriter through LocalTalk, Apple's networking system. A full page of 300 dot per inch bit-mapped graphics contains over six million bits of information. Using a standard serial printer interface at 9,600 baud setting, you would need more than ten minutes to transfer the data to the laser printer. Using LocalTalk would take less than a half minute. AppleTalk data transmission speeds are much faster than normal serial or parallel connections, which is a good reason to use AppleTalk whenever connecting a Macintosh, or any other computer for that matter, with a LaserWriter. Apple built the hardware for this networking capability into every Mac and PostScript LaserWriter.

If you use an MS-DOS computer with your LaserWriter, you can see why printing can be slow when you use the RS-232 serial port for transferring data to the printer. You'll be better off using a PC-to-AppleTalk card described in the next chapter. Print times will decrease dramatically.

You will also gain speed if you use object-oriented drawing programs like MacDraw, MacDraft, Adobe Illustrator, LaserWare's LaserPaint, 4 Paint, Cricket Draw, or the object mode of SuperPaint and GraphicWorks 1.1 for creating graphics rather than the slower printing bit-mapped variety. These object-oriented programs require much less data and print faster as a result. They also produce sharper lines without the "jaggies" common to bit-mapped programs. You get faster printing and sharper, better defined images when object-oriented programs are used to create art and graphics meant to be printed on the LaserWriter.

Connectability (What about IBM?)

Today, thousands of LaserWriters are printing documents prepared on IBM-PCs and doing it in super-professional quality. So can you; it's really not that difficult. The LaserWriters are the ideal printer for MS-DOS desktop publishing. They're reliable and reasonably priced, and they have the PostScript advantage. Please don't get into desktop publishing without comparing their output with lesser laser printers.

One way to use your LaserWriter is simply to treat it like an ordinary daisy wheel printer. The LaserWriters will emulate a Diablo 630 letter quality printer, and what you get out the printing end will look typed, yet quite plain. LaserWriters weren't meant to survive on such mundane fare. Almost any laser printer will print simple text and cost a good deal less.

An increasing number of MS-DOS software developers are producing software equipped to use many of the advanced features of the LaserWriter and its PostScript language. A number of them are described in Chapter Ten.

What you get when you couple one of these programs, such as Microsoft's Word for the IBM, to your LaserWriter is a variety of text printed in high quality PostScript fonts. These are the professional publishing typestyles that simply look better than the fonts of lower quality from most other laser printers. In addition, you get the strength of PostScript to scale fonts to the size *you* want without being limited to the type sizes in a laser printer font cartridge.

Why be stuck with cartridges when you can simply tell the printer what text sizes you want? The LaserWriters are intelligent printers; they talk, listen and do what you want. How can you beat that combination? They also grow with your system needs because they're designed to be upgradeable to new capabilities.

Apple's LaserWriter lineup gives you what you need to do the job right.

CHAPTER **THREE**

Operating Your LaserWriter

Interfacing with a Macintosh

Interfacing with an IBM-compatible

Using MS-DOS Software with the LaserWriter

What About Other Systems?

The Apple LaserWriters are publishing-oriented printers; they are miniaturized "imagesetters" capable of setting high quality type and graphics. Don't confuse the LaserWriters or any other PostScript printer with ordinary laser printers—they just aren't in the same league.

You will see the real beauty of the output from your LaserWriter when you use it for desktop publishing that achieves the creation, design, and printing of documents containing professional publishing typefaces mixed with graphic elements.

Designed primarily to work with the Macintosh, Apple's LaserWriter was built to be like the Mac—easy to use. However, the LaserWriters are more than just Macintosh printers; they're PostScript printers and, as such, are capable of dealing with virtually any computer that runs software that generates a text file in PostScript, which means anything from Apple IIs, Amigas and Atari XTs, IBM-PCs, Digital VAXs—all the way up to mainframes, even Cray supercomputers.

The LaserWriters are thus more than just printers for the Mac. They're really designed to give beautiful printouts from just about any computer. A lot depends on software. If you have software for your computer that is PostScript-compatible, you're in business. Here's how.

Interfacing with a Macintosh

If you plan on using your LaserWriter with a Mac, your job is easy. Apple has designed the LaserWriters to connect easily. All you need is the wiring and connectors for an AppleTalk interface to the printer. Any dealer can help you, and it's as simple as plugging in a toaster. You can use Apple's LocalTalk Connector Kits, Nuvotech's TurboNet, Farallon's PhoneNet or Trimar's CompuNet connectors; each supports the basic AppleTalk protocols.

If you've been used to other kinds of computers, you may think that a serial or parallel port or interface will be just what you need. Well, they work all right, but they're slow when it comes to feeding laser printers, which have voracious appetites. They gobble up as much as a megabyte of data before they even begin to print the page.

Apple's LaserWriters and PostScript printers in general need to be fed with data in PostScript format, although the LaserWriter NTX will also emulate a Hewlett-Packard LaserJet+. We'll talk a lot more about PostScript later, but for now, just know that PostScript takes lots of space to say things. It's a very

space-intensive language. And your Mac doesn't speak PostScript; it speaks QuickDraw, Apple's special shortcut for describing text and graphics that gives the Mac a lot of speed and uniformity. It almost sounds like the Mac and the LaserWriter are incompatible, but they aren't, because there's an extra step added on.

Behind the Scenes

Here's what happens when you press the OK button to print on a PostScript LaserWriter. The Mac takes each page of the document and creates a QuickDraw description of the file. At the same time, the LaserWriter driver looks at the Chooser for the name of the printer you last used and then looks around the AppleTalk network for that printer. If it hasn't been initialized and readied for printing, the driver sends the LaserPrep file to the printer. You'll see the "Initializing printer" message appear on your Mac.

Next, the LaserWriter driver turns the QuickDraw format into PostScript and sends it to the printer. If all the fonts aren't already present in the LaserWriter, there's a signal sent back to the Mac asking for the fonts to be downloaded (more about that in Chapter Six). If there's a problem (for example the paper tray is empty) you'll get a message sent back from the LaserWriter to the Mac telling you. The Macintosh and LaserWriter are intelligent machines—they communicate—and are quite busy while you sit there watching things after simply pressing OK.

Those QuickDraw files swell a lot when they are translated into PostScript. For example, a simple 15K text file sitting inside your Mac becomes 17.6K when converted to PostScript. A simple 3K MacPaint document balloons to over 15K when sent to the printer. You get super control over your output, but PostScript is bulky. All that data takes time to transmit.

The speed of getting data from the computer to the printer therefore becomes important. Although you probably never thought of the older printer connections as slow, everything bogs down when it comes to lasers, especially printing bit-mapped graphics like those from MacPaint.

Serial data transfer speeds of 9,600 bits per second seems fast. Parallel transmission rates are even faster. For sending huge amounts of data to a laser printer, however, these speeds are limiting. This is one reason that Apple developed the AppleTalk interface for the Mac and LaserWriter; it passes data at 230,000 bits per second, making data transfer times reasonable even for full pages of bit-mapped graphics. The small added cost of a LocalTalk connector kit to attach your Mac and LaserWriter together is thus a wise investment for virtually every LaserWriter buyer and cuts your waiting time 95% in relation to a standard RS-232C serial connection!

In addition to the proper cabling, you must have two software programs installed on your disk, LaserWriter and LaserPrep. Both should reside in the System folder. These programs are essential for operating your LaserWriter

and, for best results, should be the *same* version. To check this, open your System file, and select and choose Get Info. The version numbers will appear in the Comments section of the "Info About..." window (Figures 3.1 and 3.2).

Note that earlier versions were released with different version numbers. Now that's changed, and Apple is releasing them as pairs with the same version number. It will help eliminate a former source of confusion.

The LaserPrep program initializes the printer and prepares it to receive data from the Macintosh. It's needed only once during a session. When the LaserWriter is turned off, the LaserPrep will be needed again the next time you go to print.

After the printer is initialized, the LaserWriter software program converts the Macintosh's standard graphics format, called QuickDraw, to a PostScript form and sends this data to the printer. It is the printer "driver" and must be present in the System folder anytime you wish to print a document.

Before printing, you must "inform" your Mac that you intend to use AppleTalk. That's what the Chooser (Control Panel on older Mac System software) under the little Apple menu (also called the desk accessories menu) is for. Open the Chooser and "click" that AppleTalk is connected.

Next, the system must know that you intend to use the LaserWriter printer

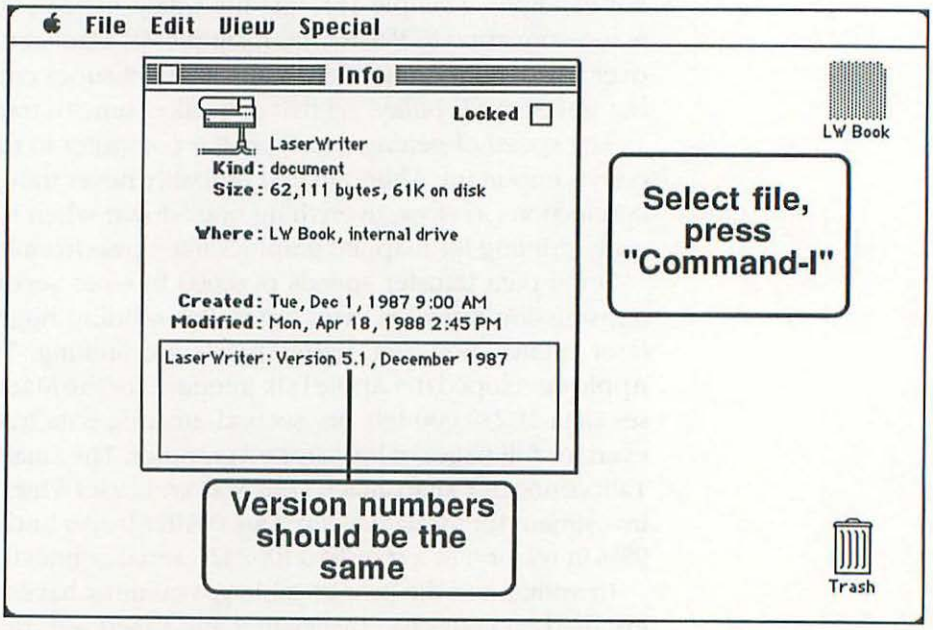


Figure 3.1. Screen image: The Get Info box for the LaserWriter driver.

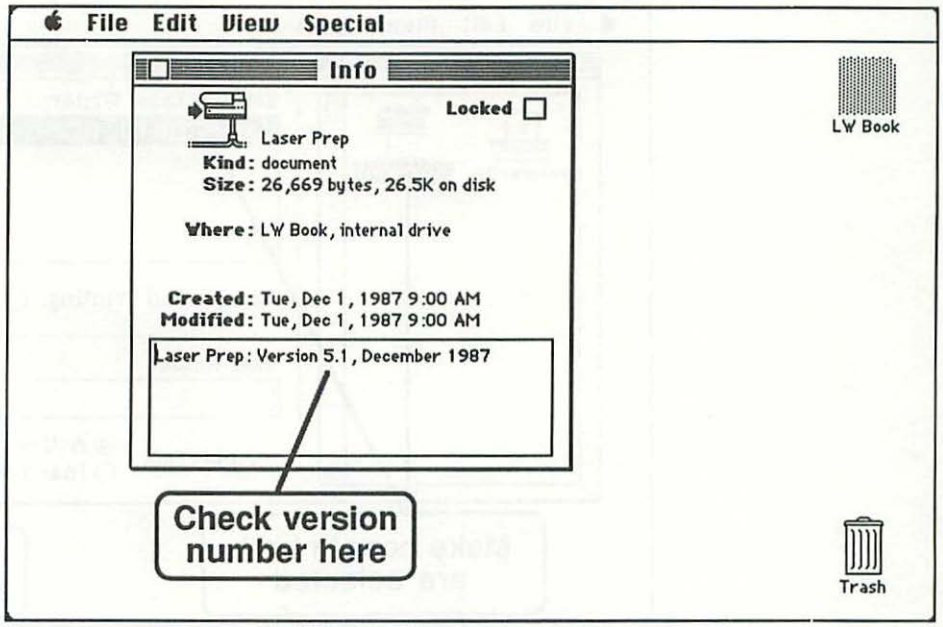


Figure 3.2. Screen image: The Get Info box for LaserPrep.

rather than some other device. You set this in the Chooser under the same menu. An icon of the LaserWriter will appear on the left and should be selected with the mouse. The name of the LaserWriter will show in the window if it is properly attached to the Mac through AppleTalk (Figure 3.3). If the LaserWriter name isn't present, be certain that the LaserWriter and LaserPrep files are in the System folder. If it appears but is dimmed, you need to choose AppleTalk first. If the LaserWriter's name isn't shown, make certain that it is turned on so it can tell the computer its name.

Going "Serial"

You can, if you wish, attach your Mac and LaserWriter by using a serial connection. Printing is slower, however. If you have a Mac Plus, use a Macintosh Peripheral Cable, Apple Part Number M0185. Connect the 9-pin end to the the LaserWriter's port, generally reserved for AppleTalk, and connect the mini-8 connector to the Mac's printer port.

If you have a Mac 512K, you can adapt the above cable to the older Mac 9-pin connector by using a Macintosh Plus Adapter Cable, Part Number M0189.

Perhaps you're handy with a soldering iron. If so, you can easily construct a cable from shielded cable by using the pin connections shown in Tables 3.1 and 3.2. Be certain to get the exact ground, transmit, and receive wires

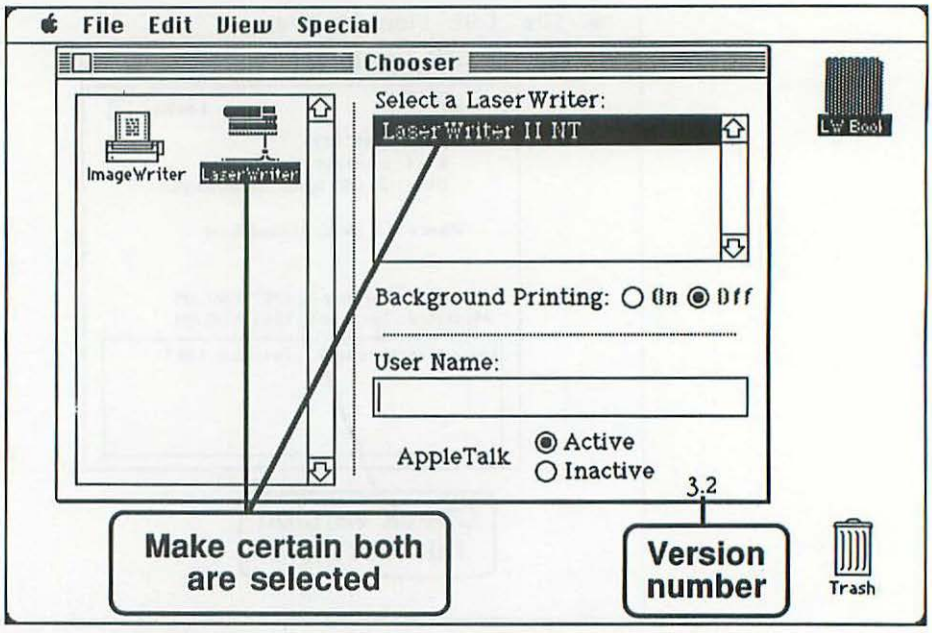


Figure 3.3. Screen image: The Chooser must be set properly for the LaserWriter to receive files from your Mac.

connected. Table 3.1 shows the pin assignments for RS-232C serial interface, and Table 3.2 shows the pin assignments for RS-422 serial interface. Note that the Mac 128, 512, and 512KE have a DB-9 plug whereas the Mac Plus, SE, and Mac II models use the round DIN-8 plugs. You will still set up the Mac's Chooser the same as if AppleTalk were being used.

Table 3.1 Pin Assignments for RS-232C Serial Interface

LASERWRITER	*SIGNAL*	*MACINTOSH*	*MACINTOSH*	*SIGNAL*
DB-25 RS-232C		*DB-9*	*MINI DIN-8*	
pin 7	GND	pin 3	pin 2	GND
pin 3	RxD	pin 5	pin 3	TxD-
pin 8	DCD	pin 6	pin 6	TxD+
pin 20	DTR	pin 7	pin 1	HSKoutput
		pin 8	pin 8	RxD+
pin 2	TxD	pin 9	pin 5	RxD-

Table 3.2 Pin Assignments for RS-422 Serial Interface

LASERWRITER	*LASERWRITER II*	*SIGNAL*	*MAC PLUS*	*MAC 512*	*SIGNAL*
DB-9 RS-422	*MINI-8 RS-422*		*MINI-8*	*DB-9*	
pin 1,3	pin 4	GND	pin 4	pin 3	GND
pin 4	pin 6	TxD+	pin 8	pin 8	RxD+
pin 5	pin 3	TxD-	pin 5	pin 9	RxD-
pin 8	pin 8	RxD+	pin 6	pin 4	TxD+
pin 9	pin 5	RxD-	pin 3	pin 5	TxD-

Actually, you don't even need a physical connection between your Mac and LaserWriter, thanks to Peripheral Land's wireless FM transmitter/receiver that replaces the standard connectors. You can be "on the air" with AppleTalk, and it's really quite inexpensive, under $150. This might be the solution to an otherwise complex cabling problem.

Interfacing with an IBM-compatible

The LaserWriters are more than Macintosh printers—they'll work with virtually any computer that can send a serial data signal. That includes your IBM-PC or PS model.

Getting the LaserWriter "look" into your IBM-PC documents can be done in either of two ways: first use software and hardware that allow direct printing from a PC to a LaserWriter or, second, translate and move your MS-DOS files into a Macintosh program for printing. The latter may be done simply by using DataViz's MacLinkPlus/PC with a serial cable or modem connection, or by using a DaynaFile MS-DOS-compatible disk drive or Apple PC 5.25 disk drive hooked into your Mac. It will read and write PC files to and from your Mac. Yet another approach is Compatible System's QuickShare PC expansion board that translates and moves data between a Mac and PC using the high speed SCSI interface. PC text and graphics are translated into MacWrite and MacPaint format, and MacWrite documents can be converted into PC-compatible formats.

There are two ways to have your Mac work with the IBM side of the world. You can actually turn your Mac into a PC clone with an add-on coprocessor card, or simply give it the ability to read MS-DOS files into one of the many Mac programs capable of opening and using MS-DOS format files—1-2-3 files into Excel, for example—and then you can save the finished work in a Mac or MS-DOS format.

Turning your Macintosh into an operating MS-DOS machine is a fairly simple and reasonably priced alternative that gives you the best of both worlds. Adding Apple's PC coprocessor card and drive, or AST's Mac86 for the Mac SE, or Mac286 for the Mac II will turn your Mac into a high-powered PC clone. If yours is a Mac 512KE or Mac Plus, the Mac+PC coprocessor board from perfecTEK will do the trick. You'll be able to run most MS-DOS software directly on your Mac, and you still have a Macintosh when you want it. With one machine, you thus get access to virtually all the personal computer business software in the world.

There's yet a newer development on the scene that gives you the best of both worlds: SoftPC by Insignia Solutions. This gem is a software emulation program which turns your Mac into an MS-DOS operating computer. This could be a peek into the future when inserting a diskette will create a complete operating system environment capable of using just about any chip that happens to be in your computer.

It's Easy with PostScript

You don't have to have a Macintosh. The Apple LaserWriter will work with any software that sends its files to the printer in PostScript language format, and it will accept these PostScript files from virtually any computer, including the IBM-PC and its workalikes.

Check to see if your software has an Apple LaserWriter or PostScript printer driver. That's the little program that converts your software's file format into one designed especially for a certain kind of printer. The LaserWriter needs its own driver with any software you plan to print. If you're using Microsoft Windows, Word, WordPerfect, or the GEM operating environment, you should be all set. These contain LaserWriter drivers.

If you're wondering if your software will work, check the section on MS-DOS software in Chapter Ten to see if it is listed. If not, check the software manual or call the company's technical help line. Many software firms are including the LaserWriter as a printer option, especially with word processing, graphics, and page layout programs that can really take full advantage of the LaserWriter's professional text fonts and graphics ability.

Hooking a PC to your LaserWriter can be done either by using a standard RS-232C serial connection or by using Apple's PC LocalTalk connection. We'll consider the AppleTalk option, which is the better one, more closely in a later section in this chapter and in the next one.

There are a few things that can help you move from your PC to the LaserWriter. For example, there is a $40 software package, The LaserWriter Connection from HUG Software, that will save you the trouble and will make the DOS `PRINT.COM` an excellent print spooler and PostScript dump program for the LaserWriter. Another utility for converting PC files to PostScript and sending them to your LaserWriter is the 123Laser/PRNLASER from 123Laser.

This software allows the choice of twelve fonts in any point size and the formatting of Lotus 1-2-3 graph files for printing on the LaserWriter.

Serial Is One Way

You can also proceed on your own to connect your PC to a LaserWriter. A standard serial connection can be made using the COM1 or COM2 serial port contained in your PC. This will work fine with the LaserWriter NTX when it is in H-P LaserJet emulation mode. If you don't have a serial port, you will have to add a card with a serial connector to a vacant slot. The LaserWriter's serial port should then be cabled to the PC. To do this, you will need a modem eliminator cable from Apple, Part Number 590-0029-00, or a null modem cable from almost any computer dealer, or you can make your own with the cable specifications described in Table 3.3.

Connect the computer's serial port to the LaserWriter's 25-pin DB-25 RS-232C connector and set the back panel mode switch to 9600 baud setting on the LaserWriter or LaserWriter Plus. If you have a LaserWriter II NT or NTX, the mode is selected using the switches that are shown in Table 3.4. When this is done, all new test pages should show the two vertical bar graphs set at 9600. The left bar will show a 9 below and indicate the speed and parity setting for the 9-pin, serial port. The right bar, marked 25, reads data from the 25-pin port. The bars' shade of gray indicates the parity setting for each port, with dark gray meaning "ignore", medium gray (which is the same as the gray used in the apple that prints out on the test page) meaning "odd," light gray denoting "even" and white meaning "none." The test page will also say which mode (PostScript, Diablo, or LaserJet+) is selected.

An Apple Imagewriter, modem cable, or a cable intended for a Hewlett-Packard LaserJet to IBM-PC should work. You can also make your own cable. For this, the proper pin connections depend on whether you have a PC, XT-

Table 3.3 Specifications for Connecting PC to LaserWriter

LASERWRITER	*SIGNAL*	*IBM-COMPATIBLE*	*SIGNAL*
DB-25 RS-232C		*DB-25 RS-232C*	
pin 1	shield	pin 1	shield
pin 2	TxD	pin 3	RxD
pin 3	RxD	pin 2	TxD
pin 4	RTS	pin 4	RTS
pin 5	CTS	pin 5	CTS
pin 7	GND	pin 7	GND
pin 8	DCD	pin 6	DSR
pin 20	DTR		

Table 3.4 LaserWriter II NT and NTX Modes and Required Switches

LASERWRITER NT USED AS:	*SWITCH 1*	*SWITCH 2*	*SWITCH 3*	*SWITCH 4*
PostScript printer	up	down		
LASERWRITER NTX USED AS:				
PostScript printer	up or down	down	up	up
Diablo	up or down	down	down	up

style 25-pin serial port, or the 9-pin variety used in the AT. See the pin assignment chart in Figure 3.4 for details.

Sending Is Next

So that the PC and LaserWriter can talk together properly, they will each need to operate at the same speed, parity and number of stop bits. This is done on the PC by setting the proper communication protocol from the computer's `Mode` program as shown on page 35.

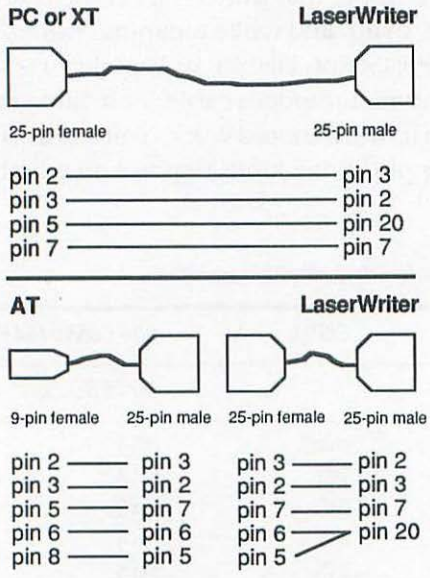


Figure 3.4. Cable diagram: Pin assignments for making a cable for a PC-XT and AT to the LaserWriter.

```
MODE COM1:96,N,7,1,P
MODE LTP1:=COM1:
```

If you have attached the cable to your COM2 port, use COM2 in the MODE command instead of COM1. Of course, these commands are lost forever when you turn off your system. To run them automatically each time you turn on your PC, add them to your AUTOEXEC.BAT file. If you get a response, "Invalid parameters," you have probably mistyped the commands. To send data to the LaserWriter, you must either use a communications program, install a LaserWriter driver supplied with your software, or use the COPY CON command. For example, using the direct approach, you can test your system hookup with the following PostScript sequence:

```
COPY CON: COM1
return
Control-D/Helvetica findfont 72 scalefont
setfont 72 720 moveto (Hello!) show
showpage Control-DZ
return
```

If all the settings are correct, the LaserWriter's green light will begin to flash and a page will issue forth from the printer saying "Hello!" in 72-point Helvetica letters.

Using a communications program such as CrossTalk from Microstuf, for example, is simple enough. Turn everything off and set the LaserWriter's rear panel switch or the dip switches to 9600 baud. Connect the computer and LaserWriter with a null modem or the cable described above. Turn on the printer and computer. The LaserWriter will print a test page showing that it is set at 9600 baud.

Open your terminal program and set to VT100 terminal emulation, ANSI, US, 80 column, on line, auto repeat, and auto wrap. Set parameters to 9600 baud, 8 bits, no parity, no handshake. File transfer will be: Text. Press Control-dt and wait until the LaserWriter responds that it is idle. Then type `executive` followed by a return. The LaserWriter will respond with its version number of PostScript and the prompt, ps>, which indicates that it is now ready to recieve a PostScript file.

For small files under 1.5K, you can use the DOS Copy command by entering:

```
COPY filename COM1
```

Longer Files Are Different

For longer files, you will need to use a data communications program as outlined above or change the transmission protocol recorded in your LaserWriter's memory from the normal XON/XOFF protocol to the DTR (Data Terminal Ready) protocol used in DOS transmissions.

To convert the LaserWriter's serial port to use XON/XOFF protocol, use your word processor to send the following PostScript command to the printer:

```
serverdict begin 0
    exitserver
25 9600 4 setsccbatch
Control-D
```

Wait at least thirty seconds and then turn the printer off. When the LaserWriter is turned back on, it will accept DOS commands under DTR. Computers using the AppleTalk port are unchanged but shouldn't be using the printer at the same time.

The LaserWriter serial port can be reset to its original XON/XOFF protocol as follows:

```
serverdict begin 0
    exitserver
25 9600 0 setsccbatch
```

With XON/XOFF protocol, larger files can be sent, and messages from the printer can be sent back to the computer and presented on the screen. LWPrint from Legend Communications is specifically designed to do this for you.

Using a LaserWriter's serial port disables the AppleTalk interface. If your LaserWriter is networked through AppleTalk, you are best off incorporating your PC through AppleTalk, too. This is an excellent interface, even if you plan to use only a single PC with your LaserWriter or other PostScript printer. Check the various methods of networking in the next chapter.

Since PC applications send data through the serial port, you will need special network software drivers like Tangent's PS Print, Apple's PC LaserWriter or TOP's TOPSPrint to send the files through the AppleTalk port.

Using MS-DOS Software with the LaserWriter

With its development of the Apple II, the Lisa, and the popular Macintosh, Apple has, for many years, given the world a look at things to come. They're doing it again with the development of a disk drive controller chip that will give the Mac's disk drive the ability to read and write to two totally different disk formats Mac and MS-DOS files. This doesn't mean that MS-DOS applications will run on the Mac, which would take a coprocessor like Apple's add-on MS-DOS card for the Mac SE and II. With the new disk controller chip, however, files will finally be really very simple to handle between the machines.

The mix of file and data formats used by various computers could, one hopes, be solved forever in the same manner. The future certainly promises far less difficulty in translating file formats than ever before. The old bugaboo about sticking with a single kind of computer to achieve compatibility at the sacrifice of using the best, most appropriate technology is really gone forever.

A Few Caveats

There are certain internal filing conventions that must be adhered to in order to satisfy both systems, however. For example, you should use file names that both computers will recognize. PS systems allow one- or two-part names with eight characters in the first part, a period between parts, and an optional three characters in the second. No blanks are allowed and there are a number of reserved punctuation marks that are not allowed.

When you are converting Mac files to be opened on a PC, remember that most data format exchange programs simply take the first eleven characters from the Mac's file name and convert them into the PC format. If several Mac files begin with the same word or two, you might get one file overwriting the other as they are converted into the same PC file.

When you are printing directly from a PC, for your MS-DOS application to have the capability of using the LaserWriter, you must install the LaserWriter driver for your software to be able to send its files for printing properly. For example, with Microsoft Word 3.0 and higher versions for the IBM-PC, you will need to use the `MSSETUP.PS` PostScript print driver by typing `COPY MSSETUP.PS COM1:` with the Microsoft Word Utilities disk in Drive A. If everything is properly configured, the LaserWriter will print a page stating, "Ready for Microsoft Word Output." The full set of LaserWriter Plus fonts can be used after configuring the `APPLASER.PRD` file to contain the Adobe AFM (Adobe Font Metrics) file that holds the character spacing and kerning data. The proper AFM data and documentation is available from Adobe Systems.

Microsoft Windows and Digital Research's GEM interface for the IBM-PC support printing by the LaserWriter and contain print drivers; although many

programs running under these environments will access only certain typestyles resident in the LaserWriter. For example, GEM Write uses only the Courier font, a typewriter look-alike, not Times Roman or Helvetica. GEM Draw, on the other hand, uses Helvetica as your single font choice from the LaserWriter. Future versions are expected to access a greater variety of fonts.

Software running under the Microsoft Windows environment must be cabled to the LaserWriter's RS-232C serial port that currently limits PCs to one computer per LaserWriter. Future versions may allow networking. Networking several PCs using Windows can be accomplished through AppleTalk using Tangent's Winprint program with its PC MacBridge Plus card.

The limited support of fonts by some of the MS-DOS software makes it advisable to ask specifically which fonts, sizes, and enhancements are supported before you buy. Remember that the IBM-PC was not designed with fonts and typestyles in mind. To see some of the special effects of font size and enhancements, like bold, italics, etc., you will need the proper graphics adapter card and monitor. You can increase the selection of typefaces for many MS-DOS programs using 123Laser's 123Laser/PRNlaser software.

There are several brands of word processing programs on the market that are available in either MS-DOS or Macintosh versions—Microsoft Word and WordPerfect, for example. These programs allow easy interchange between MS-DOS and Macintosh file formats, and both versions support the Apple PostScript LaserWriters.

Microsoft Word 3.0 for the Macintosh also supports the DCA (Document Content Architecture) file format, which many MS-DOS word processing programs use. With this capability, documents can be created on a PC, transferred to Word 3.0 on the Mac, and printed on your LaserWriter.

If your software doesn't have a PostScript or LaserWriter driver, all is not lost. Tangent Technologies has a program called LaserScript/S, which acts as a converter to PostScript, to send through your serial port to the LaserWriter.

Put Your PC on AppleTalk

Even better than the options already discussed is to use an interface specifically designed to send over the higher speed AppleTalk connection—one like the TOPS PC Interface Card for the IBM-PC, or Tangent Technologies' PC MacBridge/Plus for the XT, AT, and PS/2 Models 25 and 30, or the PC MacBridge/MCA board for the PS/2 Models 50, 60, and 80. These cards install in a PC slot and have software to select the printer you wish to use, including the LaserWriter.

Apple has a product similar to the TOPS card, the LocalTalk PC Card and the PC LaserWriter Program. Owners of a Tandy PC clone can use the TandyLink board to connect with a LaserWriter. It fits into an eight-bit slot and con-

nects directly to an AppleTalk cable. TandyLink is compatible with the TOPS network (more about that in Chapter Four) and can run at three times the speed of Apple's standard AppleTalk implementation.

In essence, one of the AppleTalk/PC cards in each PC offers a very advantageous and highly cost-effective alternative to IBM's Personal Pageprinter and is fairly simple to install and use. All you need is any software program that creates text files in ASCII, PC Write, WordStar, MultiMate, or Diablo 630 format or in Lotus 1-2-3, PIC, PRN or Hewlett-Packard Graphics Language graphics format. You would use the included LaserScript software to convert them to PostScript, or use the PCMacTxt software to convert to MacWrite format.

With Tangent's Winprint software, any Microsoft Windows application, including PageMaker for the IBM, can be printed on the LaserWriter through the much faster AppleTalk connection. Of course, the real functional and economic advantage to many users will be the easy sharing of the LaserWriter by multiple PCs through AppleTalk by using the Tangent card and software. There is also the ability to create graphics directly, using the LaserGraph program included with PC MacBridge.

Using PC MacBridge/Plus or Apple's LocalTalk PC card and PC program with an Apple LaserWriter should certainly be seriously considered by anyone interested in PC desktop publishing. Many MS-DOS programs—Microsoft Word, for example—have a PostScript driver that will allow you to send files directly to the LaserWriter. Other software, such as MultiMate, Lotus 1-2-3, or WordStar, can be sent using the PC Program. IBMs and Apples do mix, and they mix well.

Of course, IBM has its own approach, the IBM SolutionPac for Personal Publishing, which pairs its Personal System/2 Model 30 computer and its PostScript-compatible Personal Pageprinter 4216 laser printer with Aldus PageMaker software. IBM's approach, however, is personal—you have to buy a complete system, including laser printer, for each and every user. There's no equipment sharing with their system. On the other hand, by building your PC-publishing system around PC MacBridge/Plus or Apple's LocalTalk PC Card and the LaserWriter, you get a system that has the flexibility to add many more users to the laser printer, thus bringing the cost per user down sharply and, who knows, you may even want to add a Macintosh or two later on.

Although most IBM-PC programs haven't been designed with the ability to change fonts or sizes, Tangent's LaserScript software allows you to insert the appropriate commands. You can even insert your own PostScript commands if you wish (more about this in Chapter Eleven).

Be prepared for some trial and error, however. Most MS-DOS software will keep the original line and page breaks. You may have to manually adjust breaks to the new format when you change type sizes, unless you are

using software with a PostScript driver, such as Microsoft Word or WordPerfect.

Translating Those Files

Of course, you can always bring MS-DOS data into a Macintosh program and format it for printing on the LaserWriter. It's easy enough with Traveling Software's Laplink Mac, a cable/software package that will move and translate files back and forth. You won't have the ability to actually run MS-DOS programs like Lotus 1-2-3, however, since they take the coprocessor card described earlier.

Reading and writing MS-DOS data files are made especially easy with the Mac SE and Mac II computers by adding an Apple PC 5.25-inch Disk Drive through a Mac SE-Bus Drive Card or the Mac II PC Drive Card to read data from 360K disks into the many Mac programs that can accept MS-DOS data files. Dayna's DaynaFile MS-DOS disk drives will hook onto a Mac SCSI port and come in the standard 5 1/4-inch and the new 3 1/2-inch sizes.

There's also a solution on the other end of the system. MatchMaker from Micro Solutions Inc. is a half-height card for the PC that allows full use of and file transfer with an attached Macintosh disk drive. It allows PC users to read, write, change the directory, and even format Mac diskettes placed in the attached drive. There's also QuickShare, a half-height PC card and cable to the Mac, from Compatible Systems Corporation, which will transfer data between the SCSI port of a Mac Plus, SE, or Mac II and a PC. Once the systems are connected, the Mac will boot directly from the PC's hard disk and will access it as if it were the Mac's own.

Simply reading a file into another computer doesn't mean that you can then open it with your software. Some programs don't have this ability, but using a translation program like DataViz's MacLinkPlus/PC, Apple File Exchange, or AnyText /AnyGraph from Compatible Systems Corporation will solve most data transfer problems.

Graphics files can be a particular stumbling block between computers. The Graphics Link from PC Quick-Art translates between eight different PC formats including MacPaint, and Compatible's AnyGraph will take color screen dumps from the PC and translate them into MacPaint format. Graphics files can also be translated between Macintosh and MS-DOS format by using The Missing Link from PC Quik-Art or with HiJaak from InSet Systems. These file translation software products can also be used with great benefit in the networks that will be described in the next chapter.

Abaton and Dayna have similar MS-DOS input drives for the Macintosh. The Abaton drive attaches to the Mac's modem port and also works with UNIX and CP/M formats. The Dayna drive will read and write 5 1/4-inch MS-DOS disks in XT-format (360K) or 1.2MB AT-format and conveniently interfaces through the SCSI port on a Mac Plus, Mac SE, or Mac II, leaving pre-

cious bus slots free for other uses. Dayna also makes a 3 1/2-inch disk drive that will transfer IBM PS/2 data between the Mac or the 5 1/4-inch MS-DOS Dayna drive.

MacLink Plus/PC from DataViz is a very popular file translation and communication software package used with a modem on each end and an MS-DOS input drive like those described above or an optional cable between the Mac and the PC serial ports. It contains a variety of translation routines to convert PC files, such as MultiMate, WordStar, etc., to MacWrite or Microsoft's Macintosh Word file format, complete with text enhancements, including boldface, italics, superscripts, subscripts, and formatting data for tabs, margins, indents and the like. Database and spreadsheet files from most of the popular MS-DOS programs may be readily translated into Mac format and vice versa.

More and more MS-DOS programs will be supporting PostScript now that IBM has licensed PostScript from Adobe Systems, Inc., thus creating, along with Apple, Digital Equipment, Hewlett-Packard, Wang, and others, an industry standard for a page description language for high quality printing.

What About Other Systems?

Of course, there's more out there than just the IBM-PC and Macintosh computers. Computers and dedicated word processing systems have created a modern day Tower of Babel; many of them have closed and proprietary architectures, making it very difficult to move information from one system to another.

Many of these disparate systems can be made to talk to each other through networks; we'll discuss some of those possibilities in the next chapter. For now, we'll consider some of the systems that the Macintosh can now talk to, which makes them available to your LaserWriter. Others can access the LaserWriter through serial cables such as the ones described earlier. We'll discuss some of the non-Mac, non-PC software that utilizes the LaserWriter in Chapter Ten.

This discussion is a narrow slice in time, however. Getting different computer systems to share information is an exploding technology, and new solutions are being developed all the time. One recent survey of business users reports that 52% of the Macintoshes are hooked into minicomputers or mainframes.

Computer technology, of course, must be allowed to develop. We are beginning to realize that adhering exclusively to a single operating system inhibits growth and productivity gains that would otherwise accrue to users of certain applications if they were given access to a different system. This has denied many users the benefits of desktop publishing and presentations

because their companies would not allow anything but a single type of system to be purchased. The trend is changing, however, and many firms are realizing that it is better to allow new standards and systems to be aquired for their unique user benefit. One can then achieve communication between the systems rather than restrict development by nailing everyone down to a specific set, fixed and uniform technology.

Dedicated Word Processing Systems

In short, you may have a mix of older and newer computer technology that you want to make available to your state-of-the-art LaserWriter.

One of the most popular dedicated word processing systems is the Wang VS or OIS with thousands of installations. Moving Macintosh or MS-DOS files in or out of the Wang VS or OIS systems can be accomplished using file translation software like DataViz's MacLink Plus/VS or MacLink Plus/Wang OIS on the Mac, or AllegroServer software from OmniGate installed on the Wang side. Indeed, with the VS version, your Mac can now be a VS input station using the contained Wang 2110 terminal emulation mode.

MacLink Plus/VS gives Mac users full Wang workstation emulation and provides access to Wang word processing, data processing, and electronic mail. The 32 Wang function keys are available through Mac pull-down menus or from the Apple Extended Keyboard.

You'll be able to work on Macintosh applications or open VS documents into MacWrite or any MacWrite-compatible application. Conversely, Macintosh documents can be filed on the Wang VS in Wang WP format and can later be used by Wang or Macintosh users.

In addition, Macintoshes hooked into the VS can use the Wang disk storage as a file server for holding Mac or VS documents in public or ID-protected private libraries. The same functions are available for the IBM-PC from MacLink Plus/VS and the AllegroServe software. These functions make a convenient way to work in any of the three environments with data sharing or with use of the Wang OFFICE mail and message functions. For example, PC files saved on the VS hard disk can be used by a Macintosh in MacWrite format and then saved as a Wang WP file. More than twenty file translators are contained in MacLink Plus/VS, bringing text, data, and spreadsheet compatibility across these three very popular office systems.

Two-way file transfer between the Mac and Wang PC is also possible through DataViz's MacLink-Wang PC Version through modem or direct cable communication.

NBI's OASys 2000 and 3000 Series dedicated word processing systems may be connected with Macintoshes and IBM-PCs through the MacLink Plus/NBI data communication and file translation software from DataViz.

Simple data transmission between Macs and the NBI system will be facilitated with the use of NBI's Macintosh Tailor software.

Apple IIs and Others

What about sharing your LaserWriter with Apple IIe/gs computers, Macs, and PCs? There seems to be a solution to almost every problem, and more solutions appear every day.

First, the Apple IIgs has a built-in AppleTalk connector so that it can be readily interfaced with a LaserWriter. If you have an Apple IIe, the Apple II Workstation Card will interface you with any LaserWriter. You will need a LaserWriter printer driver for your software in order to get the most from your LaserWriter, however. Otherwise, you'll be reduced to using the ImageWriter emulator, which will not be of the same quality as a PostScript driver.

Another solution is the AppleWriter/LaserWriter Utilities package from Synergetics. This five-disk software package will help you use AppleWriter (ProDOS required) and your Apple IIc, IIe, or IIgs with the LaserWriter.

These three very different computers—the PC, Macintosh and Apple II—can be linked into the Data Exchange hard disk subsystem from CMS Enhancements Inc. through built-in or added-on Small Computer Systems Interface(SCSI) ports. The system has a built-in data conversion program to change MS-DOS files into Mac format, Apple II files into MS-DOS, etc. Don't look at this system as a wide area network; it isn't. It is a file server and file sharing system, and each computer must be within twenty feet of each other.

Simple data translation is often the easiest way to obtain the use of a LaserWriter. Southeastern's MacTransfer software will convert most Apple II and IBM-PC text formats into Macintosh files.

Appled Engineering, a major designer of Apple II enhancement products, is designing an add-on board and 5 1/4-inch disk drive for the Mac SE and II that will provide read/write capability for Apple II files.

Graphics files can be translated between Commodore Amiga format and Macintosh format (also between many of the MS-DOS formats, too) with InSet's HiJaak software. It can also convert Amiga and MS-DOS screen images into PostScript.

Those Bigger Machines

Terminal emulation software is now available to allow the Mac to work with practically any computer. Without going into great detail, here are some current possibilities.

BlueMac from Wall Data will allow the Mac to communicate with IBM System 34/36/38 minicomputers and 370 mainframes. The Macintosh can be used as IBM 2780 and 3780 terminals with CLEO Software's Mac-3780Plus SSM hardware/software package.

TextTerm+Graphics software from Mesa Graphics allows Mac users to edit and preview mainframe graphics by emulating the Tektronic graphics terminal. This software will output mainframe files as PICT and MacPaint format to a LaserWriter for inclusion in a page layout program.

pcLINK from Pacer Software allows the direct connection between Macintosh and Digital VAX systems via RS-232C serial ports to provide text and binary file transfers, as well as the ability to emulate one of several graphics terminals. PostScript file spooling and printing from the VAX to a local LaserWriter is also supported.

With White Pine Software's VMacS software, users can store, manage, and share Macintosh text, data, and program files through a VAX host, and also have bidirectional translation of various text files between VAX and Macintosh. White Pine Software's Reggie software package provides translation of Macintosh graphics files to Digital's ReGIS and SIXEL formats for storage and editing on DEC color graphics terminals, where color can be added to Macintosh graphics data.

The Etherport II Card from Kinetics will directly interface a Macintosh II with a VAX.

Burroughs TD/MT/ET emulation and communication can be accomplished using Contact from Avenue Software which also supports the IBM 3270, VT100 and TTY protocols. Avenue Software also has Burroughs/Macintosh file translation and transfer software. Data General D210 emulation is provided by FrontEnd from KAZ Business Systems and Lear Siegler ADM2, and Tandem's T65-10, 20, and 30 terminals are emulated by the Mac using MacMenlo software from Menlo Business Systems. Their SpoolAT software allows the use of a LaserWriter by a Tandem computer.

File transfer and terminal emulation for the H-P 2624 terminal to the Hewlett-Packard 3000, 9000 or 1000 minicomputers can be obtained through Mac2624 from Tymlabs, whose software allows the host computer to spool and print on any LaserWriter on an attached AppleTalk network and allows users to log onto CompuServe and other public networks. Even foreign language transfers can be done between computers. Similar capability can be had using the MAC-3000 terminal emulator from International Computer Consultants. Reflection for the Macintosh, a terminal emulator for the H-P 2393A, is available from Walker Richer and Quinn.

Interface of a Macintosh with a UNIX host can be obtained with EuroSoft's MacNIX through the Mac's serial port to act as a terminal and access file services. The rather simple task of bringing data into a Mac can be simply and inexpensively performed with an Abaton 5.25 disk drive attached to your Mac's modem port to read and write UNIX, CP/M, and MS-DOS diskettes. File format conversion to UNIX is possible with a file conversion utility. PICT files from MacDraw, for example, can be converted into UNIX pic format

with MDPIC from Avatar Corporation. This firm is also developing Mac to UNIX converters for other Mac file formats.

Your LaserWriter is ready for just about any computer there is. It's sitting there waiting to work with a whole office full of computers and to share in a local area network (LAN) to help lower overall costs and bring LaserWriter printing to all your computers.

Apple's LaserWriters can do just about everything, especially if you have the top end NTX configuration. You get daisy wheel emulation, LaserJet+ emulation, and PostScript all rolled into one super-printer. It may have Apple's name on it, but it connects to a whole world of computers, yours included.

CHAPTER **FOUR**

Networking Your LaserWriter with AppleTalk

The Network News

Tuning In the AppleShare Network

The AppleTalk Alternatives

Interfacing Your LaserWriter with Other Networks

Computers are very complicated devices, but the complexities grow dramatically when you attempt to hook a bunch of them together to share data and use applications together. This usually takes some complicated added hardware and software, but not if you use a Macintosh computer—the networking hardware is built into each and every Mac so you can easily hook them together to share data and peripherals like the Apple LaserWriters.

If hooking computers and printers together is something you think you'll want to do, read on. If it's not in the cards for you, then feel free to skip right on to the next chapter. You'll get right into the fun with fonts.

Hooking computers together in a network has become much easier with the current Macintosh computers. This was not the case with the original Macintosh which really couldn't communicate directly with another computer; it took a while before Apple developed its AppleTalk protocol cabling system that allows up to thirty Macs to link up, and since the development of AppleTalk, there's been a veritable explosion of communication hardware and software. Today, the Mac talks to virtually every kind of computer there is, including the Cray supercomputer, and the difficulties increase when totally different kinds of computers are being networked.

Communication between computers is such an active area of development that this chapter is already somewhat out of date, even if you're reading it only a month after it was written. This is indicative of the intense activity in networking and communication. Nevertheless, here's a solid start.

With networking, files stored on a computer down the hall can be pulled into your Mac, worked on, and then printed out on a LaserWriter in the next office that's hooked into ten other Macs. It's easy with the networking hardware, AppleTalk, and Apple's file serving software, AppleShare, because with a LaserWriter or LaserWriter II NT you've got much more than just a laser printer; you've got a *networking* laser printer.

The PostScript LaserWriters come already equipped to interface with multiple users—a real advantage over the IBM Personal Laser Printer, which is stuck with having only one-to-one relationships, an expensive way to design a laser printer meant for office and publishing tasks.

Since people in businesses usually work in groups, networking, the linking of two or more computers together to share data and peripheral devices, is an attractive and productive proposition. Information can be shared among users, and expensive peripherals, such as printers, scanners,

modems, plotters, and a central hard disk storage, can be shared among several computers. Your LaserWriter becomes a very inexpensive printer when shared among several users.

Networking computers together is an idea similar to time-sharing a resort condominium. It spreads the cost to give an opportunity for many users to benefit, but it also makes for a rather tricky scheduling problem. You don't want everyone showing up at the resort condominium at the same time, nor do you want units of data being transmitted along a computer network bumping into each other.

Collision avoidance is a must for scheduling shared resort property and for shared data on computer networks. As a result, the networking and file sharing software that runs a complex computer network is complicated and often rather sensitive.

You're lucky with AppleTalk and its many companion products. It's easy to use and manage, it's stable (you'll come to love the stability), and it's inexpensive by local area network standards.

Actually, the name AppleTalk applies to a network and to a networking protocol, the rules that govern the data transmission. This can make things a bit confusing when we discuss AppleTalk. The thing to remember is that AppleTalk is a *method* of transmitting data (the protocols) and can therefore be implemented in a great many different ways.

Apple has developed its own hardware wiring system, which was also called AppleTalk until early 1988. To end the confusion and to introduce other hardware implementations of the AppleTalk scheme in the future, Apple has taken to calling the hardware and wiring LocalTalk. LocalTalk is Apple's network cabling hardware; AppleTalk is the communication protocols. So, we'll see that AppleTalk can run on top of other networking schemes like Ethernet. It may sound confusing, but doing it is really pretty simple. That's the beauty of AppleTalk.

AppleTalk is a mature networking system with a large number of users worldwide, and there is a great variety of compatible hardware and software that you can use to create a total computing environment. Sharing computerized information has never been easier or more straightforward.

The Network News

Stripped down to the simplest basics, a computer network is a group of two or more computers linked by a cable. Along with the computers, there is generally a number of hardware devices—printers, modems, scanners and hard disks—that are also linked together into the network system.

Making it all work is the networking and file serving software. This software creates order where chaos would naturally arise and is a key component in any networking system.

There are numerous physical configurations that networks can take in linking all these pieces together. Some are star-shaped, others form circular "data highways," and others are straight-line routes. Each configuration has its own set of particular rules and regulations concerning how data is sent and how data collisions are avoided, and special LAN (local area network) system software is required to keep everything going smoothly. Most even require that a person be assigned as network manager, and this job can be a rather busy one on larger networks.

Network designs depend on the ways the hardware components are arranged, the kind of cables or wires used to connect everything together, the speed the data is sent along the wires, and the methods used to prevent data signals from interfering with one another.

Currently, LocalTalk is a straight-line network, meaning that everything is linked together off a continuous data path (Figure 4.1). In the future, there may be a ring form of AppleTalk network from Apple so that the Mac II can communicate with IBM's Token Ring network scheme. DuPont and others have devised a ring or star approach to using AppleTalk on fiber optic and telephone wire networks.

LocalTalk is a fairly slow speed network, but its internal protocols can run on much higher speed networks, even on Ethernet. Data transmission speed depends on the physical networking—the wiring—and the backbone that is used.

Speed isn't all that it may seem, either. LocalTalk is fast enough for thirty or forty users who access the network only part of the time. So don't spend lots of money for the speed of some other networking system that you may not ever need.

With networking, you can set up an electronic mail system where individual users write memos and messages to one another or send them simul-

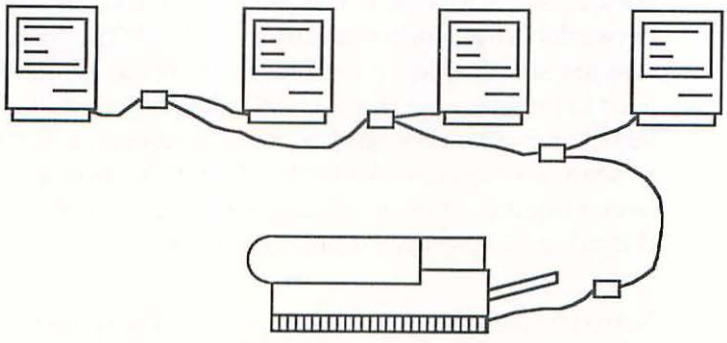


Figure 4.1. Diagram of small network: AppleTalk networks are generally straight-line bus-type networks.

taneously to several others in the network. Your message is sitting there waiting for them if they've been away from their desk, and networked electronic mail makes it easy for them to reply. You can arrive at work, check your computer for "mail" from other network members, and have your own memos delivered to each person's computer, even though they may not be at the office yet.

Networks also allow the use of multi-user software, that is, programs specifically written to allow more than one user at a time. For example, one person can write a document, and a second can do the editing and pass it along to a third team member who will create the final design and layout. With the proper software, multiple users can access the same software program located on a central data storage disk.

Finished data files can be stored efficiently and cost-effectively by sharing a large capacity hard disk to accommodate all network users. With this capability to store each network member's files and programs, your network hard disk will need file server software to allocate portions of the disk and keep track of housekeeping duties. For example, a file server will allow files to be specially security-coded so that only authorized users can access the data.

Hooking computers up in order to share data and peripherals is never a cheap proposition, but with every network scheme there is a different price to pay. On the average, an AppleTalk network will cost only about ten to thirty percent of an IBM configuration. Each has its pros and cons, but AppleTalk is growing every day in its capability and flexibility.

Tuning-In the AppleShare Network

Apple designed the LocalTalk network and the AppleShare file server not only to function as a high speed interface for it's laser printer, but also to be able to hook as many as fifty Macintoshes together so they could share data. LocalTalk is also a local area network (LAN), and there are more LocalTalk networks in the world than any other kind. The reasons for AppleTalk's success are simple. Most computer networks are complicated, costly, and they tend to be rather sensitive. LocalTalk is different. It's practically foolproof to install and use, and it has become a convenient way for multiple computers to share a single LaserWriter II NT or NTX, thus spreading the printer's cost over a number of users. In addition, you'll hardly know it's there. LocalTalk doesn't get in the way; it only helps out.

The Pluses

Networks must be able to handle the traffic quickly without bogging down. Many of the large networks such as Ethernet, transmit data at very high speeds, up to ten million bits per second. LocalTalk, in its current operating

mode, is a much slower implementation of AppleTalk, transmitting 230,400 bits per second. Does this slower speed make a lot of difference in the practical everyday business world? Yes and no. LocalTalk is of course slower and can bog down if you have a large number of users, say twenty-five to thirty, using it at the same time, but in the more practical real world where most office groups can be composed of five to fifteen workstations, LocalTalk and AppleShare work fine. You won't notice any difference, and, as we'll see shortly, your LocalTalk group can be spliced into a high speed data network if you want to hook a great many people together.

You can also have more than one LaserWriter share the network, too. Each LaserWriter will require an individual name so it can be distinguished from the others, but even if you call them all "LaserWriter," they'll name themselves "LaserWriter1," "LaserWriter2," and so on. The LaserWriter is truly an intelligent printer in many ways.

LocalTalk is flexible. It can hook a single Mac to a single LaserWriter or it can hook lots of Macs, Apple IIs and IBM-PCs together and, using AppleShare, let them share data among each other and print it out from one or more LaserWriters. LocalTalk is a network that will handle virtually any kind of computer, not just Macs. Today, about twenty-five percent of the LocalTalk networks are estimated to have PCs attached.

Networking several Macs to a single LaserWriter is the easiest task. Just buy the connectors and cables, and follow the simple "plug it in" instructions. It's really that easy. You may want to use clips to securely fasten the earlier LocalTalk connectors, since they tend to be a bit prone to loosen. Kensington Microware has such clips, which are inexpensive insurance. The current connectors are interlocking and shouldn't be a problem.

You might also want to keep track of LaserWriter usage, especially if you share a LaserWriter between departments and thus have to allocate and apportion expenses. LaserCount from LaserCount Systems is a 10K program that resides in the LaserWriter's memory and keeps individual page count statistics for up to thirty individual users.

The Problems

AppleTalk networks are generally quite stable. One note of caution is important, however. Make certain that every Mac on the network is using the *same* printer driver software (you don't necessarily have to be using the same System and Finder, just the same printer drivers). The LaserWriter and LaserPrep programs should thus be the same version on every Mac, whether it's a 512KE or a Mac II. Otherwise, inconsistencies may have you resetting the LaserWriter. Do this by turning the LaserWriter off and then back on, or use one of several desk accessory programs, such as LaserStatus, a commercial program from CE Software, or one of the popular public domain programs like ResetLW and LaserWriter Reset. A local user's group should

be helpful in locating a copy. Then, be sure to change the versions to a uniform one across the entire network. Otherwise, you might even cause a bit of havoc on the network.

Each Mac will have to have its own operating system (System and Finder): the 512KEs should be using System 3.2 and Finder 5.3; Mac IIs need (at the time of this writing) System 4.2 and Finder 6.0. Nevertheless, LaserWriter and LaserPrep should be the latest available. They are independent of the model of the Macintosh.

Watch desk accessories as well. Some will crash the network system. Start with the basic Apple desk accessories and slowly add new ones that are important to your work group. RAM disk software can also be troublesome to AppleTalk and the networking software. Proceed carefully if you plan to install RAM disk software on your system.

These few cautions are really an indication of how stable an AppleTalk network generally is. Chances are you won't have any real problems. That's not necessarily so with other kinds of networks.

Networking with AppleTalk helps keep the cost of peripherals down. Sharing a LaserWriter or AppleTalk-compatible scanner, such as AST's TurboScan, spreads the cost over a number of users.

Going "Long Distance"

Distance doesn't have to be a limit. Amplifiers or repeaters can be installed in an AppleTalk-style network to boost the total distance served by the net. Lutzkey-Baird's LBA Repeater Box, for example, will extend the length another 1,500 feet. With four repeaters, a LocalTalk network up to 7,000 feet long can be established.

Perhaps the ultimate extension of an AppleTalk-style network is the possibility of worldwide communication and data sharing through Solana's R-Server. Used in conjunction with a modem like Shiva's NetModem V1200, a remote Macintosh, perhaps even thousands of miles away, can establish a connection on an AppleTalk network to access and share network files and resources, including connected LaserWriters.

Don't forget the Apple IIe and IIgs models, either. They can be included in AppleTalk networks, as well.

More than Just Apples

Let's not forget about all those PCs out there, either. They can share in the AppleTalk easy networking solution, too. After all, your LaserWriter isn't just an Apple printer. It's a PostScript printer capable of being used by more than just a single computer. The LaserWriter is a *networking* PostScript laser printer. You'll want your PCs sharing it, too, with Apple's PC LocalTalk card. It's a better solution than IBM's Personal Publishing Pac, and its simplicity resides in the fact that all of the following combinations of hardware and

software can be used to include IBM PCs in your AppleTalk network, which can even be all PCs: Apple's PC LocalTalk card and AppleShare PC and File Exchange software, TOPS FlashCard with TOPS/DOS and TOPS NetPrint software, Hercules' Network Plus Card or the PC MacBridge Plus add-on card, and TangentShare and LaserScript software from Tangent Technologies described in the previous chapter. You get a choice between using Mac-like pull-down menus or the MS-DOS command line user interface. In addition, there are some built-in file translators for converting MacWrite to PC ASCII text files or for converting WordStar to MacWrite.

Tangent also has the WinPrint hardware/software package that permits Microsoft Windows applications on the PC to use the AppleShare file server and LaserWriter through AppleTalk and to access and exchange both PC and Mac files. Once the setup is made, PCs simply access the AppleShare server just as if it were a PC disk drive.

A Micro Channel AppleTalk card, the PC Macbridge ATB/MCA, is being developed by Tangent to bring IBM's new PS/2 series into the AppleTalk fold.

What if you only want to use PCs with your Apple LaserWriter? Well, you can have even higher data transfer speeds (three times the speed with which the Macintosh communicates), along with the ease and stability of an AppleTalk network, by using TOPS/DOS and FlashCard add-on cards just with PCs—no Macs at all. The TOPS NetPrint spooler software will convert IBM ProPrinter and Epson FX-80 output to PostScript in addition to printing Windows applications from PostScript. This makes sense for PC-based publishing systems where you want the super features of PostScript output and the simplicity and ease of networking.

If you want an all PC network that keeps things easy, simple, and working, TOPS/DOS software running on TOPS FlashCard will interface PCs through AppleTalk at speeds up to 770K bits per second, which is great for a PC publishing group.

Instead of the TOPS FlashCard, the Hercules Network Plus Card adds an AppleTalk port to a Hercules Graphics Card Plus, which is used to drive a monochrome monitor with a resolution of 720 by 348 pixels. There is compatibility with hundreds of existing programs and a RamFont mode that allows a variety of special character sets to be displayed on the PC's monitor. With this card, the PC can be linked into a TOPS network without using a new slot. A color version is said to be in the offing.

If you have a Tandy PC clone, you can simply install the TandyLink interface board in one of the 8-bit slots and hook directly into an AppleTalk network running TOPS.

In short, if your plans don't even include the Macintosh (though there's little reason to bypass such productive and work-enhancing technology), a

100% PC-based publishing system, for example, could easily operate all by itself, using AppleTalk sharing a LaserWriter or LaserWriter II series printer. This is by far the most cost-effective approach to using a PostScript printer with PCs.

The AppleTalk Alternatives

Besides Apple, other developers are working on higher speed networks that use the AppleTalk networking protocols. Tangent Technologies' approach, for example, when developed, will boost data speeds to two million bits per second—an 800% increase.

TOPS already has a 770,000 bits per second AppleTalk protocol system that uses its FlashTalk Cards for the PC and the Mac. These use standard telephone wire and can be a boon when there are many active users on a network.

Corvus's Omninet networking system operates at one million bits per second and allows up to sixty-two Macs, Apple IIs, and PCs to be interconnected through twisted-pair or telephone wiring. Even Digital VAX and MicroVAX computers can be integrated into Omninet.

Generally, the distance of AppleTalk networks should be no longer than 1000 feet maximum, but other vendors, such as Farallon, are using existing telephone wiring to go longer distances—up to 3,000 feet. The unused yellow-black pair of wires can often serve as AppleTalk cables. If these wires are already being used by the telephones, new wiring will have to be provided.

Farallon's PhoneNet is cheaper than Apple's system, and with its PhoneNet Repeater, the network can be extended to several miles. PhoneNet can be interfaced with existing LocalTalk cabling. In addition, Farallon's PhoneNet Plus Connectors are optimized to support future AppleTalk designs with data transfer speeds up to one megabit per second while still using standard telephone wiring.

A similar offering is Nuvotech's TurboNet System, which uses ordinary telephone wire and positive locking connectors. TurboNet networks can be configured for distances as great as 5,000 feet and can be mixed with existing LocalTalk wiring. CompuNet from Trimar and Modunet from DataSpec are similar offerings.

Talking by Light

DuPont's fiber optic AppleTalk cables also allow greater distances—up to 4,900 feet between each station. The fiber optic system is designed to be functionally compatible with AppleTalk, and users would be unaware of any difference. The electrical AppleTalk signals are automatically converted to light pulses, sent along the fiber optic cable, and then converted back into

electrical signals at the other end. Not being electrical, fiber optic cabling is not subject to electrical interference and does not require expensive shielding, conduits, or cable trays. DuPont also has a dual optical port connector card that resides inside the Mac II cabinet for enhanced data security for sensitive applications.

Though AppleTalk is a bus-type network with all components in a single straight line like Christmas tree lights, Farallon and DuPont have concentrator units available to allow a star network to be configured from AppleTalk. The Farallon PhoneNet StarController can support up to 3,000 feet on each branch of a twelve-pole star network. With such a star network, as many as twelve AppleTalk networks are arranged into work groups that can be reconfigured or brought in or out of the star network as needed. The star network manager simply clicks on the network diagram appearing on his or her Mac screen. With a system like this, one could use existing phone wiring to network an entire building on AppleTalk. The DuPont fiber optic system works in a similar manner.

Corvus Omninet networks can also be configured as a star network using simple office telephone wiring with the Omninet Hub controller. Stations may be up to 4,000 feet apart and as many as twenty-five hubs can be connected together to serve thousands of stations.

Bridging the Gap

Another way to hook several complete AppleTalk networks together to form larger "bridged" networks, or to split up a full AppleTalk network to add new users, is through the Hayes InterBridge, Solana's R- or I-Servers, or Shiva's Netbridge. These networks may be in the same office or thousands of miles apart "talking" to each other through modems over long distance telephone lines. Bridging networks helps to smooth out the traffic, too, so that network speeds are maintained as activity increases.

Dataspace also has a system that makes AppleTalk networks accessible over telephone lines from remote locations, which is a handy option for including input from distant users.

We've already discussed using your building's telephone wiring to link AppleTalk-style networks together. Another such scheme is Northern Telecom's Meridian SL-1 Private Branch Exchange (PBX), which allows up to four AppleTalk networks to be connected together through existing telephone wiring using a Hayes InterBridge, a Solana R-Server or I-Server, or a Shiva Netbridge. Each network can be located as far as 4,000 feet from the Meridian PBX, so that a Macintosh user 8,000 feet away from a LaserWriter on the other side of the network can use it just as though it were a local printer. The LaserWriter icon appears on the screen exactly as if it were attached directly.

An even more ambitious networking scheme from Northern Telecom is the LANstar AppleTalk Network that will network as many as 1,344 devices—PCs, Macs, LaserWriters—through telephone wiring. In addition, AppleTalk bridges may be added to bring in earlier Mac networks to the system. LANstar's data transmission rate is ten times that of LocalTalk, so that large work groups can be configured with little drop in response time.

More on TOPS

The TOPS Network is another solution to mixing together PCs, Macs, and even Sun workstations and Digital VAXs with LaserWriters through an AppleTalk network. With TOPS, you can open a MacWrite document using WordStar and vice versa, and Excel can be used to read and write Lotus 1-2-3 files. PostScript-format files can be sent from any computer in the TOPS network to a shared LaserWriter. Thus, PCs and Macs could use MacWrite, WordStar, and either version of Aldus's PageMaker or Quark's Xpress to produce pages from a LaserWriter.

If your particular PC software package doesn't have a PostScript printer driver, you can print from the TOPS network to the LaserWriter as a Diablo 630 printer (you'll get the typewriter-looking Courier typeface, of course, and it will be monospaced, not proportional), or you can use the TOPS NetPrint utility to embed typeface, style, and size in your documents. You won't see it accurately on the monitor, and you will be restricted to Times and Helvetica, unless newer versions tap the extra fonts in the LaserWriter Plus and II models. 123Laser's 123Laser/PRNLASER software will allow MS-DOS files to tap any of twelve typefaces in any size and send them directly over TOPS to the LaserWriter. The TOPS network also allows you to print from Microsoft Windows applications.

One difference between Apple's AppleShare networking software and the TOPS network is that Apple's scheme requires the dedication of a Mac to act as the network host and file server; TOPS distributes the task between the networked Macs, which allows the use of all computers, which can also act as file servers. TOPS, which can also include Digital's VAX and the Sun workstation, offers a repeater device for its network so that signals may be sent longer distances. Futhermore, unlike Apple's LocalTalk, which is a strict straight-line bus network, the TOPS network can be configured in a star network with a TOPS Star controller. TOPS networks can also run at higher speeds using its FlashTalk cards and TeleConnectors—up to 770,000 bits per second .

Even PC-style networks, including IBM's Token Ring, can be included in a TOPS AppleTalk network using Banyan System's Vines network operating system on a PC to bridge the two. Indeed, Apple has disclosed that it is also working on an intelligent network adapter to interface Mac IIs into an IBM Token Ring LAN.

Dayna Communications is also developing an all-Macintosh networking software to compete with that of Apple and TOPS, but it will use an inexpensive PC clone as a file server.

A TOPS network can be interfaced into a Net/One LAN from Ungermann-Bass and allow the PCs and Macs in the TOPS network to use the Net/One file server. Other network file servers are Corvus's OmniDrive Network Server and Constellation Software, and InfoSphere's MACServe.

AppleTalk is a simple, yet powerful networking protocol. Look for a great deal of product development activity to continue to enhance the utility and performance of AppleTalk as a communications tool. The future of AppleTalk as a network scheme is just beginning. New developments are being announced almost daily.

Interfacing Your LaserWriter with Other Networks

Can AppleTalk exist in the land of the big-time computer networks? The answer is simple. Stanford University's 90 mainframes and 8,000 workstations and microcomputers are linked together from 300 buildings using a combination of 19 AppleTalk and 64 Ethernet networks. Likewise, Dartmouth has linked up 6,000 Macs, a VAX/VMS cluster, a UNIX-based VAX, and a Cray supercomputer using 82 AppleTalk networks linked together through 95 bridges. AppleTalk is definitely playing a key role in large LAN designs.

Into Ethernet

UNIX-based computers are commonly connected using Ethernet, a popular high speed local area network developed by Xerox Corporation, to connect a number of computers and peripherals together having the ability to share files and storage. These nets transfer data at much higher speeds—up to forty times faster—than does Apple's LocalTalk, but they are more expensive to install and maintain.

AppleTalk-linked computers can be integrated into an Ethernet or an IBM Token Ring network using 3Com's 3Server3 network server and its 3+ software. Transparent file sharing and LaserWriter spooling and printing are provided to all users on the network. The AppleTalk network can be using AppleShare locally while being part of the overall Ethernet system. Electronic mail and file access security are also provided.

Another solution is Lutzky-Baird's UltraOffice system that links AppleTalk-networked Macs and PCs with UNIX-based hosts to provide an operating environment for UNIX, Mac, and MS-DOS applications, including electronic mail, shared LaserWriter spooling and printing, central library and disk storage, terminal support, and voice annotation that includes voice messages in Macintosh documents.

If you have a Mac II in your network, direct access to Ethernet is quite simple with the Apple EtherTalk Interface Card, Kinetic's EtherPort II or SE Ethernet card, Information Presentation Technologies' IPT 1000 card for the SE, or Dove Computer's FastNet SCSI or II cards. To run the Apple A/UX Operating System, you simply need 2 megabytes of memory, the Motorola 68851 Page Memory Management Unit, and at least 40 megabytes of hard disk storage. With the Apple's EtherTalk Interface Card or 3Com's EtherLink/NB Card, you can easily interface into a local Ethernet network of PCs running 3Com's 3+ networking software.

SuperMac Technologies has developed for the Mac II an AppleTalk card, SuperMac I/O, which provides printing facilities for A/UX, Apple's implementation of UNIX. The card supports print spooling and works under the Mac operating system.

Ethernet networks can also be accessed through the Mac's SCSI port with Kinetic's EtherPortSE or the FastNet SCSI Network Interface from Dove Computer, thus freeing the internal slots for other functions. The FastNet Interface will also connect the Mac Plus, SE, and II to DECnet, StarLan, PCNet, and IBM's Token Ring.

Excelan's LAN WorkPlace products are hardware/software combinations that will interface PC-DOS, PC-UNIX, and XENIX 286 and 386 with Macs on a TCP/IP (transmission control protocol/internet protocol) -based Ethernet LAN.

Mac IIs equipped with the card can also be linked via an AppleTalk cabling net through a 3Com 3Server3 file server, which has connector ports for both AppleTalk and Ethernet.

The TOPS network for the UNIX operating system will integrate Macs, PCs, and Sun workstations on a UNIX computer so that files, disk storage, and peripherals such as the LaserWriter can be shared.

The VAX Connection

The graphic interface of the Macintosh makes it a very convenient workstation for Digital Equipment's VAX computer. Indeed, recent estimates claim that over one-third of all VAX sites have Macintoshes hooked in.

There are several ways to link Macs and VAXs together. The first uses asynchronous communication and file transfer with a terminal emulation program to make the Mac work like a VT-100 or 200 terminal. This can be accomplished using Griffin Terminal 100 from Metaresearch, MacLine from TouchStone Software, MicroPhone from Software Ventures, Pacer's PacerLink, or Smartcom II from Hayes. Programs like VersaTerm and VersaTerm Pro from Peripheral Computers and Supply, Metaresearch's Teknikolor, and Tekalike from Mesa Graphics will emulate the Tektronics 4015 terminal and are even more versatile.

Communication programs lacking file translation capability can also be used by allowing Linkware's file translation utility to do the conversion.

Digital Equipment Corporation's VAX minicomputers and UNIX-based systems can be included in your AppleTalk network hooked onto your LaserWriter. You simply need the X-810 communication server, from Solana Electronics, which resides as a node on the AppleTalk net. It uses bidirectional parallel and serial ports to allow users to establish data paths and allocate memory usage between the connected devices. Your VAX-based publishing system can be linked into your LaserWriter for printing proofs and editing copies before you send the final to a phototypesetting unit.

The FastPath AppleTalk-to-Ethernet bridge from Kinetics Inc. will conveniently allow the inclusion of AppleTalk-networked Macintoshes with any Q-bus, Multibus, or Ethernet-networked group of computers, including Sun, Pyramid, Sequent, Integrated Solutions, and Digital VAXs. Combined with the FastPath, EuroSoft's MacNIX/Net software package will provide a Mac-like desktop interface to the UNIX operating system and permit file transfer between the two operating systems simply by dragging file icons.

GatorBox, from Cayman Systems, is another intelligent LocalTalk-to-Ethernet gateway that lets Mac users operate AppleTalk protocol applications on Ethernet. With the GatorBox, Macs on an AppleTalk network can share files with Ethernet-based VAX terminals, PCs, and UNIX-based systems as if they were part of the AppleTalk network. LaserWriters can be shared among all the included users.

With the VAX and AlisaTalk software from Alisa Systems, files on the VAX are readily translated and used by Macintoshes, and plain text or PostScript files from the VAX side of the system may be printed on a LaserWriter residing in the AppleTalk network, just as though it were a DEC Printserver 40, a high speed, 40 page per minute PostScript laser printer. Thus, the much less expensive LaserWriter may be used locally for proofing and small jobs rather than the expensive Printserver 40. A spooler is also included to receive and hold the files from several users and to feed them for printing so that the computers themselves are free to do other work. This software package allows Macintosh files to be printed through the DEC Printserver 40 PostScript laser printer. They appear as ordinary LaserWriters in the Chooser and no modifications are required for use.

Kinetics also has a print spooler of its own, K-Spool, that collects files on the Unix host for printing on an AppleTalk-connected LaserWriter. Terminal emulation software is also provided to allow Macintoshes to act as UNIX terminals.

PacerPrint from Pacer Software also enables VAX/VMS users to access a LaserWriter in their network and provides PostScript conversion of common VMS text and graphic files, including Tektronic 4014 and ReGIS files. This

approach is especially attractive when it is configured by using 3Com's 10-megabit per second Ethernet protocol that allows standard telephone wiring to be used for this very high speed data transmission.

TOPS/VMS, a version of the popular TOPS networking system, will enable a VAX to act as the central TOPS network file server, giving Mac and PC users easy access to VAX facilities. It can also connect Macs and PCs to an existing Ethernet network.

Mac240 software, from White Pine Software, permits text to be transferred between Macintoshes and VAXs and allows the movement of graphics from the VAX to the Mac. White Pine's Reggie software will convert and send bit-mapped and object-oriented Mac graphics files from the Mac to the Digital VAX and its peripherals.

DataViz also has file translation software for the Mac and VAX systems, called MacLink Plus/DEC.

In addition, 3Com Corporation's 3+ software package will allow similar functionality to exist between AppleTalk nets and IBM-PC-based Ethernet and Token Ring networks.

Pacer Software's PacerLink software is a fully functional interconnect package designed to connect PCs and Macs into the Digital VAX through Ethernet, AppleTalk, or Corvus's Omninet by using the Kinetics FastPath AppleTalk to Ethernet bridge. Other large hosts, including Cray, Prime, and Stratus computers, can be interfaced with PCs and Macs in this manner. With their PaceLink Spooler, the host computer will hold the files for printing on the LaserWriter, thus freeing up the Macs. In this way, a VAX can act as a printing spooler for an entire network of Macs.

With Pacer's PacerShare, the VAX can be configured as an AppleShare file server and will allow both Mac and VAX files to be accessed by Macs on the network.

The Corvus Omninet networking system will integrate Macs, Apple IIs, PCs, and VAX computers and can be extended through the use of repeaters. Provisions also support interfacing with Unibus machines and Q-bus systems.

Thursby Software's TSSnet and Technology Concept's CommUnity-Mac software allow you to integrate your Macintosh into an existing DECnet network. With the TSSnet, DEC computers on the network can connect directly to as many as 64,000 Macintosh nodes to provide access to VAXs while you are using the familiar Mac interface. DECnet users are able to print using LaserWriters connected into the Macintosh nodes. These products offer a complete sharing of DEC files and bring the functionality of DECnet to Mac users, including such features as electronic mail.

Dove Computer's FastNet, a high-speed network communication control gateway built around the Motorola 68000 microprocessor, provides an inter-

face from small office networks into various high-speed nets, including DECnet Phase IV Ethernet networks. Coupled with Technology Concept's CommUnity, DECnet compatibility can be achieved for a variety of computers including IBM-PCs and compatibles, Macintoshes, and UNIX systems.

Caught in the Big Net

Apollo Computer's Series DN3000 and DN4000 UNIX-based supermicros can be used as an Apollo token ring or Ethernet file server for networked Macs with the company's U-Serve AppleTalk adapter card and software package. Added modules offer electronic mail, VT100 terminal emulation, and print spooling. An AppleShare-compatible file server package for Mac-Apollo networking, called uShare, which is available from Information Presentation Technologies, will let a Mac II emulate an Apollo workstation and will also use the host as a print spooler.

Tandem T6510, T6520, and T6530 computers can be integrated into an AppleTalk network with Menlo's MacMenlo, which can incorporate graphics into Tandem host applications. The mainframe can also act as a LaserWriter spooler with the included SpoolAT software.

Pyramid networks can also link with AppleTalk using Pyramid's ACP (AppleTalk Connectivity Package). Using ACP, Macintosh users can store and retrieve files from a Pyramid minicomputer host, and Pyramid users can access LaserWriters stationed in the AppleTalk network.

Novell's networking systems are also including support for the Mac and its peripherals with recent releases of their NetWare LAN software.

ARCnet networks can also add Macs with Netdesign's Actinet SE card, which passes data at 2.5 megabits per second, ten times faster than LocalTalk.

You can also print UNIX documents on a LaserWriter using Adobe System's TranScript software to translate Diablo 630 troff, ditroff, plot, text, or scanned raster image files into PostScript format.

The various implementations of AppleTalk may give the impression that there is a growing divergence among them, but AppleTalk keeps a uniform thread throughout. This is why InfoSphere has developed Liaison, a software bridge that communicates between any interface card that uses the AppleTalk protocols and another. With Liaison, you can connect LocalTalk through EtherTalk, for example.

Whatever your current computer and network system is, it's likely that the LaserWriter will serve your needs well. This is especially true if you have a documentation or publishing group. The memory expansion and hard disk storage for fonts makes the LaserWriter II NTX a great asset. The LaserWriter's PostScript-compatibility, ready availability, and economical cost assure that it will remain a top choice for printing high quality documents from any computer system.

CHAPTER **FIVE**

Font Basics

The Elegance of Type Design

Using Type Instead of Typing

Two Kinds of Fonts—Bit-mapped and Laser

Built-in Laser Fonts

Those Handy "Hidden" Characters

The Apple LaserWriters are special—and for good reason. They produce a wide variety of typestyles and sizes just like those used in magazines, newspapers, and books. You aren't stuck with a print that looks like it's from a typewriter and is just as boring.

With the LaserWriter's different typefaces, styles, and sizes, you have complete control over your work's appearance. No more dull, lifeless documents. You're a publisher.

Perhaps you aren't used to having all these choices. Well, you're in for a whole new world. That's what makes the LaserWriters the most popular laser printer for publishing. You get choices—lots of choices—and the expensive look and feel of a professionally-typeset document is yours for the asking.

Once you use a LaserWriter, you'll never go back to Courier, a text typeface with the look of a typewriter font.

The Elegance of Type Design

There's an entire profession devoted to designing the typefaces used in printing, and it's an old and honorable one. Some typefaces have been designed for readability; others, called *display* type, are more decorative. Most of us don't really notice the type used to print the things we read, but if you use a Macintosh or a LaserWriter for long, you'll become very conscious of the world of type. First though, it might help if some terms are set clearly so you know exactly what we're describing.

There's a basic design for a particular type. That design is called a *typeface family*. Times, Helvetica, and Bodoni are typeface families. Unfortunately, when the Macintosh computer was being developed, the term *font* was used instead. It should have been *typeface family*.

A family is broken into typefaces having certain sylistic qualities—thin, medium, bold, italic, oblique, outline, etc. Thus, Helvetica is a typeface family and Helvetica bold italic is a typeface. We haven't even gotten to fonts yet, either.

Here goes: A *font* is a typeface in a particular size, i.e., Helvetica bold italic, 12 point. We will try to hold to these traditional definitions in our discussion of type.

Done by Design

Typeface designs can be broadly broken into two categories: *serif* and *sans serif*. Serif type is distinguished by the presence of small extensions, called

serifs, at the end of the strokes forming the letters and by the fact that the strokes and lines used in making the character vary in width. Times Roman and Century Schoolbook are two popular examples of clean, readable serif type (Figure 5.1).

Sans serif characters, on the other hand, are created from strokes of virtually the same thickness and terminate cleanly, without serifs. Helvetica and Avant Garde are two commonly used sans serif typefaces.

Serif typefaces are often used for blocks of text and, in small sizes, are judged to be more readable than sans serif typefaces. However, very small sizes, under eight points for example, tend to run together and blur to the eye. Use a sans serif typeface for those small point sizes. Headlines and larger type sizes are often set in a sans serif typeface because of its clean, airy look.

There are a few other terms used in describing type that will be useful with certain software driving your LaserWriter.

Coming to the Point

We've already mentioned the size of the typeface as being part of what makes up a font. Type sizes are usually described in terms of *points,* which are approximately seventy-two to the inch. (Actually, there are 72.46 points in an inch, but that's too small to quibble about.)

Point size refers to the height of the type, including the lower case descenders that drop below the line. The use of point sizes, of course, came about long, long before we had computers.

The point size for a font is actually greater than the height of the actual typeface. Why? Type used to be cast from metal, and there was a little metal just above the typeface and just below. But point size measurements included everything, even the excess metal. Point sizes measured the entire height of the block of type. That's why the actual printing from different typestyles will not always have the same height. Try putting two different 36-point typefaces next to each other. It's likely that they aren't the same exact height (Figure 5.2). Consequently, point size isn't always as good a measure as one might like. It's the traditional measurement, though, so we're stuck with it. At least you know that it's not an absolute measure of the actual height of a typeface.

Figure 5.1. Serifs: Serifs generally make the text easier and faster to read.

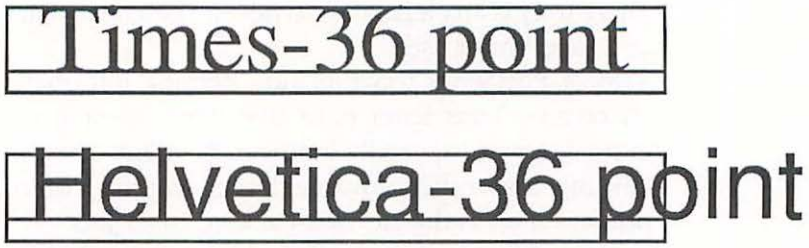


Figure 5.2. Times and Helvetica 36-point: Idential point sizes don't always mean that the printed dimensions are the same.

Coming to Terms

There are several other terms used to describe type that we need to know about. *Leading*, pronounced "ledding," is the distance between lines of type or the amount of space between *baselines* (Figure 5.3). Some programs, particularly page layout and full-featured word processors, let you change the amount of leading or linespacing to improve readability or to achieve special effects.

Take particular note of how various programs treat leading. Some will add it to the bottom of each line, and others will average it between the line above and the line below. Unfortunately, there is no hard and fast rule, but it's something you should be aware of.

One will often want to move letters closer or farther apart to achieve a more attractive look, especially with large type sizes such as those used in headlines. The individual letters used in headlines are often moved closer together, a technique called *kerning*, to achieve a more pleasing effect. Figure 5.3 shows how kerning can actually tuck small letters under larger ones. Look at front page newspaper headlines; you'll see good examples of kerning.

You can control kerning with most page layout programs. There is also a kerning control utility, LetrTuck, from Edco Services. It allows you to set the degree of kerning on each Macintosh font.

Begin to observe typestyles in the things you read. Ask yourself why the designer or publisher used certain combinations of faces, styles, and sizes.

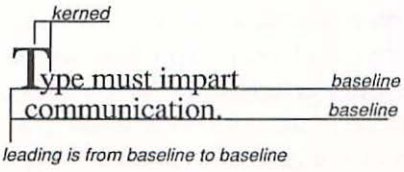


Figure 5.3. Baseline and leading: A few key typographic terms.

There truly is an elegance to type—an elegance that's now within your reach as a LaserWriter user.

Most PostScript fonts include kerning information for selected pairs of characters. Thus letter pairs that need kerning to look best together are moved closer, especially in larger, headline-sized point sizes. Don't expect kerning and other advanced typographic control from non-PostScript printers such as the Hewlett-Packard Laser Jets.

Gutenberg invented moveable type and thus changed the face of mankind's culture forever. Today, type is not only moveable, but it's also computerized and capable of being transmitted by telephone or satellite. Unlike the wooden and metal type of the past, digital type can be shaped and formed at will. We're only beginning to see what this new technology will bring.

Using Type Instead of Typing

If you've been using a LaserWriter, you've already discovered that the Courier typeface is dull, dull, dull. It just looks like ordinary typing right out of a 1936 Smith-Corona portable—hardly deserving of such space-age discoveries as lasers.

Typewriters and their computer-interfaced cousins, the daisy wheel printers, put out rather boring, lifeless text. After all, you're stuck with one size of type and not much more in the way of enhancement.

If you print words to communicate, then using the old daisy wheel and typewriter technologies is like speaking in a dull, monotonous voice. No emphasis, no modulation. Just dull.

Type That's "Spaced Out"

Typewriters print with monospaced characters, which means that each letter and number is given the same exact width, even though an actual letter *m* is wider than an *i*. Your eye expects a more pleasing proportion with narrow characters having less width than wider ones, but a typewriter or a daisy wheel can't create it.

On the other hand, typeset documents generally use proportional typeface families. We're more accustomed to proportional type because newspapers, magazines, and books are printed that way, and it's faster and less fatiguing to read (Figure 5.4).

With your LaserWriter, proportional type is yours in just about any size or enhancement so your words have that professional appearance that can only add to their purpose and persuasiveness. You also get a lot of minor variations that can also make your work look great. Just as in true typography, you can have different weights of typeface. You're already familiar with boldface, but some faces also come in ultralight, light, medium, and extra

Courier, a monospaced typeface

Helvetica, a proportional typeface

Figure 5.4. Courier and Helvetica:
Monospaced versus proportional typefaces.

bold. A few others come in a tall, narrow version. The LaserWriter Plus, LaserWriter NT and NTX, for example, have Helvetica Narrow as one of their permanent typefaces.

Of course, bringing fonts, typefaces, and typestyles to the computer means there's more for you to learn, but, if you use a computer to communicate, then you can communicate more effectively when you begin using professional, attention-getting typefaces. I'm not suggesting that you go crazy and begin to pepper your memos with fonts, fonts, and more fonts. No, "overfontitis" is a sickness that could banish you to Courier forever.

Remember, communication is an art, and the proper use of typefaces can help attract attention to your documents, improve readability, and facilitate understanding.

Writing to Be Read

If you're concerned with readability (and you should be), there have been numerous studies on how easily and accurately various typefaces can be read. To guide you, Table 5.1 and Table 5.2 show the results of a survey by

Table 5.1 Headline Copy Typeface Preference

HEADLINE COPY		
Typeface	*Reader's Ranking*	*Art Directors' Ranking*
Caslon Bold	1	2
Helvetica Medium	2	1
Franklin Gothic	3	6
Optima Semi	4	3
Souvenir	5	4
Avant Garde Demi	6	5
Century Bold	7	9
Egyptian Bold	8	7
Claredon Bold	9	8
Kabel Black	10	10

Table 5.2 Text Body Typeface Preference

BODY TEXT COPY		
Typeface	*Reader's Ranking*	*Art Directors' Ranking*
Helvetic	1	2
Garamond	2	3
Melior	3	4
Century	4	1
Times Roman	5	6
Universe	6	5
Optima	7	7
Avant Garde	8	8
Caldonia	9	9
Bodoni	10	10

Cahners Publishing Company of 2,000 business readers and 300 advertising agency art directors who were shown ten different typefaces.

Some of the typeface names in these tables may not be familiar to you, but several in each list are available directly from your LaserWriter. This will give you good, basic typefaces to choose from and provide even more possibilities when you discover about downloaded typefaces in the next chapter.

Two Kinds of Fonts—Bit-mapped and Laser

When discussing how computers and printers handle typefaces and styles, we're a long way from the old chunks of lead type that Ben Franklin used. Our fonts are electronic and easy to change and manipulate.

Computer typefaces come in two general kinds, and a good understanding of each is necessary to get the best out of your LaserWriter.

First, there are bit-mapped fonts (or, more accurately, typefaces). These are the familiar ones used with an ImageWriter dot matrix printer—Chicago, Geneva, New York, and Monaco. They're composed of a dot pattern that appears on the computer screen and is simply printed "as is" from the screen to the dot matrix printer.

If you're limited to printing on Apple's ImageWriter dot matrix printer, Mac designers have tried to improve the characters' appearance by using a dot pattern twice the size called for in your document and by printing them in the area required for the smaller size. Thus, the high quality print mode takes the dot pattern for a 24-point letter and compresses it to fit the 12-point space. This "double-density" printing requires that you have the double-sized font

size available in your System file; otherwise, you won't get the high quality. In other words, if you want to print 12-point type in high quality on an ImageWriter, you also need the 24-point size installed.

Bit-mapped Macintosh fonts are rather crude and choppy in appearance, and even printed from a LaserWriter, they don't look much better, which is a good reason to stick with the laser fonts described below. If you have to include a bit-mapped font in your piece, be sure to have the Smoothing option set to "on" for printing so the bit-mapped letters will look less jagged.

The Other Guy's Fonts

The H-P LaserJet or LaserWriter II SC also use bit-mapped typefaces. Of course, there are lots more "bits" or dots used to make each letter, but they're still made up from a dot pattern design, which means that each size of font has to have its own set of bit-mapped designs. If you took a 12-point size and simply enlarged it to 48 points, it would look rather choppy. Yet most laser printers use bit-mapped fonts and store each size individually. Keeping track of all those bits requires lots of memory, so most laser printers, with their plug-in font cartridges, don't offer you many typesize choices.

For example, Hewlett-Packard's LaserJet II allows the simultaneous use of two font cartridges. Plugging in Cartridges Y and Z allows you to work with the assortment of fonts shown in Table 5.3. If this seems a lot, you've never used an Apple LaserWriter. Unless you resort to using software fonts, your wonderful desktop publishing layout will be restricted to the fonts in the size and style selection offered in two cartridges—pretty slim pickins! That's why PostScript printers like the LaserWriter are so popular for this demanding application.

Font size selection is a severe limitation to most laser printers, not just the Hewlett-Packard models. The Cordata LP-300 can't handle typesizes greater than 24 points, and the Canon LBP-A1 and LBP-A2 are restricted to point sizes of 12 and 16 points, respectively. You'll probably also notice that the LaserJet font called "Helv" looks like "Helvetica," but they're not the same,

Table 5.3 H-P LaserJet II Fonts (Cartridges Y and Z)

Courier	12-point	roman, bold, italic
Helv	14-point	bold
TmsRmn	14-point	bold
Helv	12-point	roman, bold, italic
TmsRmn	12-point	roman, bold, italic
Helv	10-point	roman, bold, italic
TmsRmn	10-point	roman, bold, italic
Helv	8-point	roman
TmsRmn	9-point	roman

because Helvetica is a copyrighted design and trademark for the actual typeface from Allied Merganthaler. H-P doesn't license the actual professional typesetting typeface design. You get a clone—almost but not exactly the same.

A Better Way to Do It

The Apple LaserWriters use the true Merganthaler typeface design that has been encoded into digital form by Adobe Systems. You get the real thing when you buy a PostScript printer, and you get access to more of the real thing when you want even higher quality typesetting from a Linotronic phototypesetter. It's easy to take your file from a LaserWriter directly to a typesetter, which is something you can't do when you go with a non-PostScript system.

When you use your Macintosh or IBM-PC, you see a *screen font* on the monitor. Screen fonts are a coarse approximation of the appearance of the text font that you're using, and they are a form of bit-mapped font; they're made up of tiny dots or pixels. Screen fonts come in various sizes, and you install them in the System File.

When printing with the ImageWriter, you'll need screen fonts present in the same size in which you will be printing. If printing in high quality text mode, the ImageWriter needs a point size twice the size as the final text because the ImageWriter prints the larger size's dot pattern in the smaller point size space to achieve a denser print.

Two Fonts for the Price of One

When using a LaserWriter, however, you're dealing with two kinds of fonts—screen fonts and laser fonts. As explained earlier, screen fonts are bit-mapped, but when you use the LaserWriter with software that allows you to freely specify point size, you don't need to have the exact screen font size installed in your System file to print in high quality from the LaserWriter. The text's appearance on the monitor, however, will suffer.

For ease of reading and editing on-screen, though, you should make sure you have the correct sizes installed. It's easy to check. Currently installed screen font sizes appear in outline print in the Mac's Style menu. Missing screen fonts are bold, filled-in sizes. Even though a particular screen font may not be present, the LaserWriter will nevertheless print its typical high quality typefaces in that size.

With a Mac 512 Enhanced or with a newer machine, up to 200 individual typesizes of screen fonts may be installed in the System file. Of course, you'll need a hard disk to hold them, but if variety is your goal, the Mac can satisfy all but the hungriest font maniac.

The computer must, of course, be able to keep track of all these fonts and it must know which is which. To do this there is a Font ID Number attached

to every Macintosh font. Numbers from 0 to 512 are used, and the font developers are restricted from using ID numbers below 128 by Apple, who has reserved them. With so many developers creating fonts, the possibility of having two fonts with the same ID number is growing, which is something to remember if you get the wrong font printing out.

The second kind of electronic or digital type that we are concerned with here is the scalable outline typeface, and it is most familiar as the PostScript laser font. These are the high quality typefaces that print out at the 300 dot per inch resolution capability of a modern desktop laser printer like the LaserWriter and are also able to print from even higher resolution devices like typesetters. These fonts are truly "letter-quality" and suitable for most routine business publications. The LaserWriter's typefaces can to be scaled into almost any size you want with no loss in quality (Figure 5.5). Most software has a maximum font size, often slightly under 128 points.

Built-in Laser Fonts

If you have an original LaserWriter, it contains four built-in typefaces: Courier, a typewriter look-alike; Symbol, a math, language, and scientific typestyle; and two popular publishing faces, Times and Helvetica.

If you're serious about desktop publishing, the LaserWriter Plus and LaserWriter II NT and NTX give you, in addition to the above four, the following typefaces: Palatino, Avant Garde, Bookman, Helvetica Narrow, New Century Schoolbook, Zapf Chancery, and Zapf Dingbats. In case you don't remem-

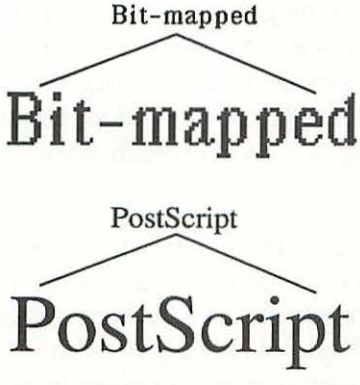


Figure 5.5. Changing the size of one of the LaserWriter's PostScript fonts can be done without losing quality.

ber what each one looks like, you can install MenuFont from Beyond Software. It puts the actual typeface on the Font menu. No more guessing.

These typefaces, familiar ones used in typesetting and printing, have been translated into PostScript form and then placed into permanent memory chips (ROM) inside the LaserWriter.

One Point Makes All

These PostScript laser typefaces are in the form of mathematical outlines of each character's shape. Your LaserWriter stores just a single size font (in fact, it's stored at one-point size), so that when you want a particular size, such as 48-point, the Motorola 68000 microprocessor chip inside the LaserWriter (this is the same kind of chip that runs inside your Mac Plus or SE) calculates the new size, fills it with black, and then converts it to a bit-mapped raster scan that gets "shot" through the laser.

All these typefaces are stored in a single small size, ready to be enlarged to the exact sizes you need. This font storage in mathematical outline format really is a great way to "inventory" fonts. You can scale fonts from 4-points all the way to 400-points just from the original font description.

With PostScript, one size really does fit all, and fonts don't take up lots and lots of memory, either. A complete character set needs only 15 to 75K. Generating all the sizes you need, however, takes quite a lot of mathematical figuring, which is why the LaserWriter has its own powerful computer chip.

You gain several real benefits using outline fonts, such as Adobe's PostScript fonts, that are built into each LaserWriter. For example, you get speed. Drawing the image of an outline font takes less time than constructing the image from a bit map. You also get scaling—just the size you want and in the same high quality. All this takes much less memory for storage, too. You would need hundreds of megabytes of storage to contain bit-mapped typefaces in the styles and sizes that your LaserWriter can provide. Perhaps most important of all, especially for those using the LaserWriter for publishing, the LaserWriter typefaces are device-independent—they can be printed on any PostScript imaging device, even high quality typesetters.

A Calculating Style

Some laser typestyles are created mathematically, too. Italic and bold styles are often (but not always) created from the plain text form by applying a mathematical routine to "oblique" or to "boldface" the character shapes. This mathematical creation of the bold styling from the plain or roman typeface often leads to bold characters that are too wide. Installing the bold and italic screen fonts available from Adobe will create a more true-to-life character spacing.

You won't always get the same selection of typestyles that traditional typesetting has offered, however. In typesetting, a typeface family will often contain many different styles and weights that aren't available from the Macintosh. For example, some type families have four weights of bold (light, demi, bold, and ultra). In the same manner, the Macintosh can create up to 64 styles using its built-in QuickDraw routines on the screen fonts. You'll get them from the ImageWriter II, but don't necessarily think you'll get each and every combination (a bold-shadow-outline combination, for example) coming out of your LaserWriter.

Even sideways or "landscape" printing is done by mathematically rotating the typefaces rather than having to have a landscape font available taking up memory waiting for the occasion you need it.

Screen Fonts—A Must

In order for you to use the typefaces residing in your LaserWriter, your computer software must be able to access them, which means that at least one size of the screen font must be installed in your software so that the font name appears on the Font menu. Installation of screen fonts is usually done with Apple's Font/DA Mover.

Fonts are usually installed in the System file where they are available for use by all the applications on the disk. You can, however, install fonts in individual applications to be available for just that program. For example, you might want to install a decorative typestyle like Zapf Dingbats into a graphics program, but you don't want it cluttering up the Font menu in your word processor.

To install fonts into individual applications such as MacWrite or SuperPaint, for example, use the Font/DA Mover as usual but press the Option key while clicking on the Open button on the right-hand scroll box. This will put all applications and documents in the window. Just go ahead and select the application and proceed to install fonts as you would normally. Removing any oddly named fonts like "9" from applications will often cause a bomb error, so it's best to leave these alone. Just add fonts into applications; don't remove any that you didn't put there originally.

Once the screen fonts for the LaserWriter typefaces are available in your application program, you're ready to create documents using these high quality typefaces. The new typefaces not already present in the LaserWriter, i.e., those that you are adding, must be installed as both screen fonts in your System file, using the Font/DA Mover, and the downloadable font file placed on the start-up disk in the System folder.

How many fonts can you install? Theoretically, you are limited to having 200 typefaces and sizes. Take care here, however. There have been reports that putting more than 136 fonts in a System file will cause problems.

Suitcase from Software Supply is a font and desk accessory manager that allows the installation of up to 520 desk accessories and 2,000 typefaces and sizes on your system. That, one hopes, should satisfy the most profligate font user. A similar utility, Font/DA Juggler Plus from ALSoft, handles fonts, desk accessories, and function keys alike. It allows you to view all of the current fonts in each of nine styles.

If disk space is a concern, you can create some room for more typefaces if you eliminate certain sizes that you don't think you'll need. You can also eliminate sizes that are very close to the sizes you'll be using. For example, you don't need the 9-point size if you have the 10-point size already installed. The Mac will scale the screen font slightly but not enough to distort and render it unreadable from the screen. Remember, your laser typeface will still scale perfectly to the size you need for printing.

You can also increase the number of fonts by installing the extra ones in individual applications as described above.

Those Two Special Files: LaserWriter and LaserPrep

In order to print out your creation on the LaserWriter, you need two special programs called LaserPrep and LaserWriter.

When you print to your LaserWriter for the first time after turning it on, it looks backward to the Mac for the LaserPrep program, which it then downloads into the printer's memory, where it stays until you turn off the printer. LaserPrep is a series of PostScript procedures that emulate QuickDraw.

The LaserWriter program is a printer driver that translates the file from Apple's QuickDraw description to a form of Postscript and then sends the file to the printer. Now resident in the printer's memory, LaserPrep completes the final translation from a QuickDraw-dependent form of PostScript into a pure form of PostScript for printing. The LaserWriter driver also looks to the printer to see if all the typefaces that will be needed by the document being printed are available. If not, it looks to the computer so that the computer can send the proper laser typeface file to the printer (this is downloading, and we'll talk about this in more detail in the next chapter). If the typeface is not available in a PostScript laser form, the computer will send the bit-mapped screen font to the printer, and you'll have a rather choppy typeface showing up in your otherwise beautiful printout.

If there are times when you want to include a bit-mapped font in a document being printed by a LaserWriter, use the Font/DA Mover to place the largest bit-mapped font size you have available. The LaserWriter will scale it down to the size called for, which will result in an improved appearance.

Since downloaded typefaces take a little more time to print, choosing among the wide variety of typefaces present in the LaserWriter Plus or II

models will be the most efficient. Remember that the built-in typefaces are there when you need them, just waiting for your next creation.

Those Handy "Hidden" Characters

One of the great features of Macintosh computers is their ability to handle various typestyles and sizes. They have brought an entirely new range of possibilities for written expression to the general public and average business user. Yet this richness is hidden behind what seems to the casual observer to be a rather small, simple keyboard, especially on earlier models. One way to tell if someone really knows about the Mac is by learning what they have to say about its keyboard. Hearing someone say that it's dinky and can't come close to the great IBM keyboard simply tells you that they really haven't used a Mac very much. You see, the Mac keyboard is really twice as big as it looks. If you're a Mac user, you already know about the Option key and the alternate keyboard that it makes available. There's an entire second keyboard underneath.

The Mac allows you to do all kinds of things with text. Not only can you change typefaces or styles within a single line (or word, if you so desire), but you can also call upon a whole universe of "hidden" characters waiting for

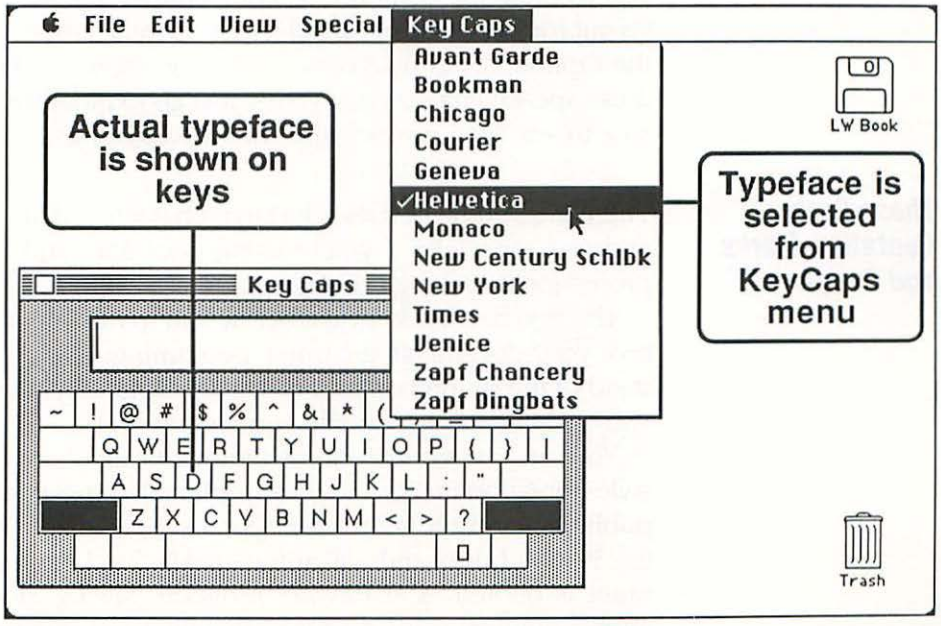


Figure 5.6. Screen image: Select the typeface from the Key Caps menu.

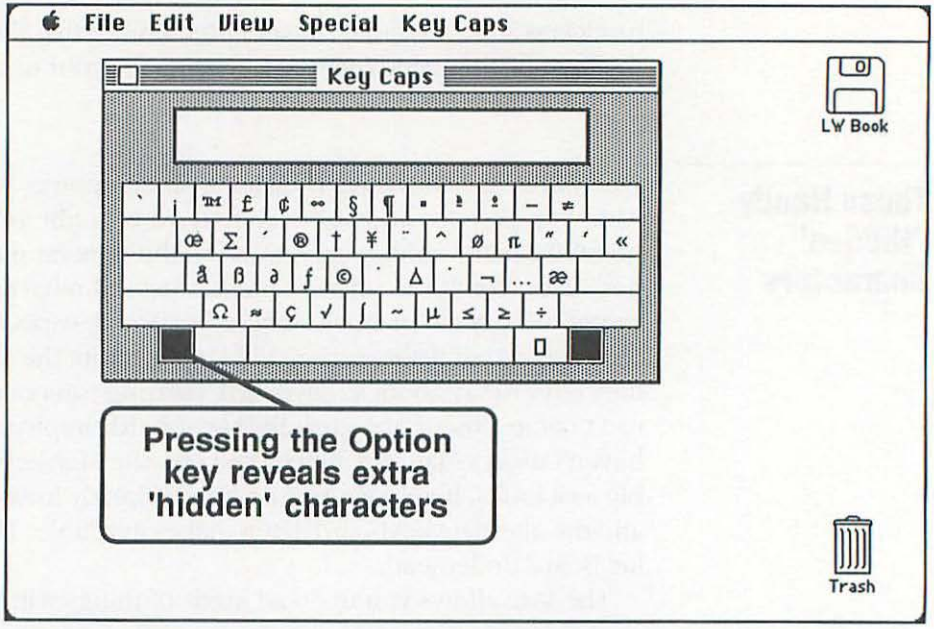


Figure 5.7. Screen image: There's a wealth of additional characters to be found using Key Caps.

you to press the Option key. For example, Figure 5.6 shows the Key Caps layout for Helvetica in capital letters. Contrast this with the same keys while the Option key is held down, which is shown in Figure 5.7. Every one of these special characters is yours. Just go explore the Key Caps window. Be sure to see what pressing the Option key brings.

Those Curly Quotation Marks and Bullets

There are several of these "hidden" characters that you should get to know and use especially if you're using your Mac and LaserWriter to produce professional-looking documents.

The two bracket keys just below and to the left of the backspace key will give your documents the true typesetting quotation marks, “, ”, ‘, and ’, instead of the straight up-and-down typewriter-style ones on the key below: ' and ". All it takes is a simple Option key shift.

You can have your Macintosh automatically change the normal typewriter-style quotation marks and apostrophe into typographic curly ones with the public domain program Laser Quotes. The Laser "Quotes" file is placed in the System folder and will automatically load into memory when the computer is booted. A shareware program, Macify, does this also and much more—automatically. Also note that the newest versions of PageMaker will

automatically change imported text to curly typographic quotation marks if you hold down the Option key while selecting the Place command.

There's also the handy bullet (•) used for emphasis. It resides as Option-8. Remember that you can change its size using the Style menu if you want a larger or smaller bullet. This will change the line spacing, however. If you need to avoid enlarging the leading, or line spacing, use the large bullet character in Zapf Dingbats and reduce it to the required size. It is the L character from the keyboard.

Or, you may want to add emphasis with a diamond (◊) using Option-Shift-v, or make a note with the daggar mark (†) from Option-t.

Another typographic symbol is the ellipsis, those three dots used (...) to indicate when something is left out. The ellipsis is obtained from Option-;. You'll see that a real ellipsis, when bounded by two added upright lines, looks slightly different from three period characters in a row, as shown below. Notice that the ellipsis has a narrower spacing between dots and a wider spacing after the third dot.

|...| an ellipsis
|. . .| three periods

Dash It All

You can also choose among three different dash marks. There's the regular dash, actually a hyphen, to the right of the "zero" key. Then there are two typographer's dashes, called en and em dashes, gotten by pressing Option-hyphen and Option-Shift-hyphen, respectively.

hyphen -
en dash –
em dash —

Hyphens, of course, are used for hyphenating words, en dashes are used for separating dates (e.g., 1985–1987) and for making minus signs, and em dashes are commonly used to set off parenthetical ideas in a sentence. PageMaker 2.0 and higher will automatically replace double hyphens with an em dash.

You can also have ™ (by pressing Option-2), ® (by pressing Option-r), and © (by pressing Option-g) symbols in most font selections. You may have looked in vain for the Command key cloverleaf symbol, or for the check mark that you sometimes see on Mac menus. For Mac SE and II users (i.e., any Mac with the 256K ROMs), the cloverleaf Command key symbol is accessed by pressing Control-Q, the Apple logo is Control-T, and the check

mark is Control-R. If you have an older Mac (except 128Ks) the public domain program, "Laser Quotes," will allow you to access them.

Font Explorer from Heizer Software allows you to incorporate the cloverleaf and check mark symbols into documents, which is a great help, especially to users writing computer documentation. Casey's Page Mill and Emdash also supply a font with many of the Macintosh characters, including the Command key symbol.

Writing with an Accent

If foreign languages are your forte, you can have accent marks over letters. All you need to do is to find the right accent mark—an acute accent (´), a circumflex (^), or an umlaut or diærisis(¨), for example—using the Option key in Key Caps, type the accent key sequence first, and then the letter. The accent will then be correctly superimposed on the letter. The accent marks and additional letters from foreign alphabets that are available to you are shown in Table 5.4. Using accents won't work with just any letter, however. Apple programmers built in this foreign accent capability to work with only those letters of the alphabet that need them. Once again, here is an indication of the careful thought that has gone into the design of the Macintosh and its peripherals.

You also have access to a wide variety of foreign punctuation marks, monetary signs, and math and scientific symbols from the standard text fonts.

Table 5.4 Accent Marks and Additional Letters

ACCENT	*TO PRODUCE:*	*ENTER THIS:*	*FOLLOWED BY:*
acute	á, é, í, ó, ú	Option-e	the letter
	É	Option-e	E
grave	à, è, ì, ò, ù	Option-`	the letter
	À	Option-`	A
circumflex	â, ê, î, ô, û	Option-i	the letter
umlaut (or diærisis)	ä, ë, ï, ö, ü	Option-u	the letter
tilde	ã, Ã, õ, Õ, ñ, Ñ	Option-n	the letter
cedilla	ç	Option-c	
	Ç	Option-C	
	å	Option-a	
	Å	Option-A	
	ø	Option-o	
	Ø	Option-O	
	ß	Option-s	

If these aren't enough, the LaserWriters also come with a mathematical language and scientific font called Symbol.

Top Secret

There's even a character that's so secret it isn't even there—the "hard space," an unbreakable space that is handy to put between the initials of a name so that no matter what editing takes place later, the two initials won't get broken at the end of a line. You can't see it, but it's easy to find; just press Option-spacebar.

Even ligature pairs are available from the Macintosh and LaserWriter. These are the special letter pairs that are sometimes put together by typographers either to add a bit of style and class or to respond to the requirements of foreign languages. For example, some, such as œ, are available directly from many of the LaserWriter fonts. Others, such as fused fi and fl pairs, can be created from the Mac keyboard as shown in Figure 5.8. Simply invoke the keyboard commands as shown. This doesn't work with all typefaces, though. It is generally a feature of serif type families.

The availability of these special typesetting characters is proof enough that the LaserWriter is no ordinary printer and that the Macintosh is no ordinary computer. Indeed, you have the basics of typesetting at your fingertips. A great many of these things simply can't be done on the IBM-PC. Try creating the ligature pairs described above using a PC.

Also note that the temperature degree mark (°) is generally available from two places on the keyboard. Option-shift-8 gives a larger degree mark than does Option-k. Also note that the Symbol typeface has a degree mark obtained by pressing Option-5.

Macintosh/LaserWriter enthusiasts are often accused of a blind loyalty to their system. A more realistic explanation for their zeal is that this combination is extremely well thought out and carefully designed as typographic and graphic communication devices unrivalled in their ability and ease of use. That's not all, either. We haven't even begun to explore the full possibilities for typestyle and font manipulation on your LaserWriter. That's next.

fi —> fi Shift-option-5

fl —> fl Shift-option-6

Figure 5.8. Ligature pairs: The LaserWriter even generates ligature pairs in which the letters are fused together.

CHAPTER **SIX**

Handling Type Fonts on Your LaserWriter

Adding New Fonts

Downloading Fonts Automatically or Manually

Sources and Examples of Fonts

Designing Your Own

One of the real beauties of the LaserWriter is that you have access to a wide variety of typefaces—and they're professional publishing typefaces, too. You're no longer stuck in the dull, listless world of drab, monospaced, typewriter-looking print. The Courier typeface can (and should) be relegated to the "mind set" of the button-down boys who demand to have reports look just as if Ms. Smithers from the steno pool typed them.

Today, we are in a new age. Desktop publishing, a term that means a thousand different things to as many people, is a well entrenched part of corporate life. Why? Because it makes sense and saves dollars—lots of dollars. All those items you used to send out to the local printshop and then waited days and even weeks for can be yours in a matter of minutes or hours.

Take for example one simple task that practically every business must undertake: price sheets. What happens when the marketing department decides to change prices, and they want to send out new price sheets this afternoon? With a desktop publishing system such as a Mac and LaserWriter, you can have the new price pages in your boss' hands within fifteen minutes —and they'll look like you sent them out for printing. Before the advent of desktop publishing, you probably would have done the price sheets on a typewriter or delayed the price change until the local printshop delivered the finished typeset copies.

Now, you can easily have just about all the "goodies" that the professional world of typesetting has. With the LaserWriter NT, you already have eleven professional publishing typefaces at your disposal, and you can have more. The LaserWriters are designed to take on new typefaces, and there are lots of them available.

In addition, the whole desktop publishing revolution has created a large demand for PostScript typefaces. We'll discuss many of the ones that are available as this book is being written, but there will be many, many more by the time you read this. That's to your advantage as a LaserWriter user. You have a variety of typestyles that are the envy of every computerist.

Adding New Fonts

You don't have to be satisfied with the typeface families that come pre-installed inside your LaserWriter. In fact, if you have an original LaserWriter, you should consider upgrading it to a LaserWriter Plus. The cost—less than a thousand dollars—is modest enough, and you'll have more than just Times and Helvetica to play with.

Regardless of which LaserWriter you have, you can take advantage of its ability to use added typefaces. Part of the LaserWriter's memory can be used to hold new designs. We'll talk about how these new ones get into the LaserWriter later. Right now, we need to remember that it takes two kinds of typefaces: screen fonts and PostScript typeface files.

We could talk about sending bit-mapped fonts to the LaserWriter, but their quality is rarely as good as the true PostScript kind, and they can't be scaled to the size you need. After all, why restrict such a fine printer to lower quality fonts?

So, we need both the screen font and the software PostScript font file. The screen font has to be there both for your software to know that you want to use that particular typestyle and for the computer to put a representation of it on the monitor, complete with the correct character spacing so the line lengths break on-screen in the same places that they do in the printed copy.

This may sound simple, but turning an ordinary computer into a font-handling desktop publisher is no simple task. First of all, you have to assign a distinctive number to each typeface so the computer and printer know which is which. If you ask for Helvetica, you don't want Bookman coming out of the laser printer. So each typeface has its own number.

Keeping Track of Things

If each font didn't have its own Font ID number, the system would really have a problem keeping track of things. As we mentioned in Chapter Five, of the total 512 possible font numbers, Apple has reserved the first 128 for themselves. (Remember that Apple started using the term *font* for *typeface.* It really should be the latter term.) If you use a lot of different fonts, you may find conflicts between fonts that have the same ID number. This can happen between disks, but shouldn't happen from the same disk. The Font/DA Mover renumbers any font with the same ID number as a previously installed one, thus eliminating any conflicts, but, other font installation programs or font extender programs, such as Font/DA Juggler or Suitcase, leave font ID numbers unchanged.

If you do get conflicts and find the wrong font printing out, you'll have to remove the offending font or reinstall it with the Font/DA Mover. Otherwise, you may have to change its Font ID number with one of the font editing programs described later in this chapter or with the Font/DA Utility and Font Resolver included with ALSoft's Font/DA Juggler Plus software.

Of course, to represent the laser typeface on the monitor properly, there's a screen font to match the look of each laser typeface. The Helvetica screen font on your monitor has a "hook" on it that tells the LaserWriter to calculate and print the Helvetica PostScript font inside the LaserWriter. That's how you begin to get the much-desired WYSIWYG or "what you see is what you get" relationship between screen and printout.

Actually, as long as the screen and printer have different resolutions or dot densities (the Mac is 72 dots per inch versus the LaserWriter's 300 dots per inch), you'll never have perfect WYSIWYG. For example, on the screen, characters can be moved in relation to one another only in increments of 1/72 of an inch, or one screen dot or pixel. Laser characters, however, can be moved toward or away from one another in much finer steps. Some software packages, including Microsoft Word 3.02, T/Maker's Write/Now, and WordPerfect, allow the fractional printer spacing to be used, which improves the appearance of your documents.

In effect, the Mac-LaserWriter combination really is a WYSINQWYGBIC, or "what you see is not quite what you get but it's close" system. Lest you think this a deficiency, look at the non-Macintosh world of desktop publishing. You often get WYSIECTWYG or "what you see isn't even close to what you get"—a distinct operating problem when you try to lay out type accurately on your computer.

It Takes Two to Typeset

If you think we've digressed, here's the payoff: for your computer to access a typeface in the LaserWriter, it needs the appropriate screen font. The key to getting new fonts to work with the LaserWriter is to install the appropriate screen font in the System file. Only then will the new typeface's name appear on the listing of the Font menu.

Typefaces that are added on come in two parts, just like all the others: screen fonts and laser faces. The difference is that you must install both forms. The screen font is usually installed directly inside the System file by using the Font/DA Mover, and the laser typeface file is installed by simply copying it onto the disk and placing it in the appropriate disk location, usually the System folder. Some fonts, however, come with their own specific installation instructions which should be carefully followed.

If you have a difficult time remembering the shape and style of all the fonts you're using, then MenuFonts from Beyond Software will be a big help. This little gem creates a Font menu in which the font names appear in their own typeface.

Keeping lots of fonts available for use when you want them is the job of Suitcase from Software Supply or Font/DA Juggler Plus from ALSoft. These handy utilities will allow you to have an unlimited number of fonts or desk accessories resident in your system. Font/DA Juggler Plus also shows each font name in the actual typeface to help you remember how each one looks—a nice feature when you have twenty or thirty typefaces installed on your Mac.

System 6.0 handles fonts differently; up to 32,000 individual typeface sizes can be used. Fonts will have to be converted to a new format, however. This is accomplished with Font/DA Mover 3.8.

Downloading Fonts Automatically or Manually

With your LaserWriter, there's room in the printer's memory to receive new typefaces, in the form of software, that are sent from your computer, especially if you have a LaserWriter II model. These are the downloaded fonts or typefaces, and there are two ways to send them to the printer—manual or automatic. As you have already guessed, the difference between the two is that you must get involved in the process when manually downloading typefaces, and you don't when they're automatically downloaded. You're absolutely correct.

In downloading, your selection of designs is almost unlimited. We'll discuss some of the available software typeface families that are on the market, but with any listing for such an active area, our discussion is already out of date. You'll get a good, solid start here, though. Many, many new laser-quality fonts are being designed every day to fill the demand of desktop publishing. Quite a few current MS-DOS programs, however, lack the ability to access downloaded fonts, and some are even limited to using the original LaserWriter trio: Times, Helvetica, and Courier.

Doing It Yourself

Manual downloading uses a special program to send the font file to the LaserWriter where it stays until you turn the printer off. Manually downloaded typefaces will print faster because they're already there in the printer waiting to be used during subsequent jobs. Of course, you have to repeat the downloading procedure each time you turn on the printer.

There are several font downloading programs; some come on the disk with the fonts from the suppliers, others are public domain programs that you can get from a local user's group. Adobe's Font Downloader and Altsys's LW Download are examples of such programs. The former has the ability to read and report the free memory available in the LaserWriter for downloading. CE Software's DiskTop and LaserStatus will download fonts and can also determine the amount of free memory in the printer. It also allows you to reset and clear the memory of the LaserWriter directly from the Macintosh, a handy feature that will save you from turning the LaserWriter off and on again. Being a desk accessory, LaserStatus will download both fonts or PostScript text files directly from within Macintosh applications.

We also need to mention Apple's LaserWriter Download Utility, which is included with the LaserWriter II models. This will allow you to send new fonts or typefaces to the printer's memory or direct them to the attached hard disk on an NTX model.

Font files may also be manually downloaded from any kind of computer by sending the PostScript font file to the LaserWriter before any printing jobs. The file should be begin with the following PostScript code:

```
serverdict begin 0 exitserver
```

After sending the font file, you should immediately send a Command-D character sequence to the LaserWriter as an end-of-job indicator.

Even with 1.5 megabytes of memory, the LaserWriter and LaserWriter Plus don't have much extra memory to hold typefaces that have been manually downloaded. A great deal of memory is set aside for handling the data on the page—all the text and graphics. Remember that bit-mapped graphics fill up memory rather quickly and that the various sizes of the text typefaces must be calculated and stored temporarily prior to printing the page. You can expand the memory of a LaserWriter or LaserWriter Plus with MassMicro's MassFonts plug-in memory expansion card.

If the typefaces weren't held in memory until the page was printed, each character in each required size and style would have to be created every time it was needed on the page. For a page of text, you don't want to be recalculating the shape of the 12-point Helvetica letter *e* each and every time it appears on the page. The LaserWriter does it once and holds it to see if it's needed again on the same page. This is called *font caching*.

There are other things that have to fit into the LaserWriter's available memory capacity, too. The LaserWriter and LaserPrep programs, and, if you're using PageMaker, AldusPrep, all take room.

Running Out of Memory

The LaserWriter and the LaserWriter Plus have slightly different memory allocations, with the latter having a bit more free memory available for fonts. With a LaserWriter having 1.5 megabytes, plan on using a maximum of about three or four downloaded typefaces. With any more, you're liable to get a PostScript error saying there's not enough memory to process your document. Then you may have to reset the printer and begin over with a new test page issuing forth. Of course, there are also good, solid design reasons to stay away from "overfontitis."

With PageMaker, however, it is possible to print an almost unlimited number of typefaces in a document. If you get an "out of memory" error, try printing each page separately until you get to the offending page. Then enter this page and break those text blocks having multiple typestyles into several separate text blocks. Why does this work? PageMaker's AldusPrep uses the LaserWriter's memory on a text block by text block basis, not on a full page basis. Only four typefaces are allowed in a single text block in Version 2.0 of PageMaker.

In addition, having LaserPrep and AldusPrep in memory at the same time severely reduces the amount of free memory and may also slow things down. So, if you are switching back and forth between PageMaker and other Mac programs, you may want to reset the LaserWriter in between PageMaker and the others. In the past, PageMaker has used its own AldusPrep program in place of LaserPrep, and both will reside in memory unless the printer is reset,

thus clearing precious memory space. Turning the printer off and then back on will do the trick. Using CE Software's LaserStatus desk accessory is even easier. It clears the LaserWriter's memory without turning off the power, which eliminates the need for the printer to be reinitialized.

Current versions of PageMaker (2.0 and higher) will also work with LaserPrep (Version 4.0 and higher), so you can avoid this memory conflict altogether. If your document doesn't contain bit-mapped paint graphics or many downloaded typefaces, then LaserPrep should work fine.

In addition, PageMaker allows the option of using less than the maximum page area for printing. Doing this will free added space for downloaded fonts, which will increase the available memory by 90K. Similarly, the new versions of LaserWriter and LaserPrep (version 4.0 and higher) are automatically configured to use the extra area of memory previously reserved for the maximum graphics image for downloadable font storage. If full page graphic images are to be printed, choose the Larger Print Area (Fewer Downloadable Fonts) option from the LaserWriter Options set-up menu.

Doing It Automatically

For most users, manual downloading isn't worth the trouble. Automatic downloading is easier (you don't do anything—it's really automatic) and can be more versatile.

First of all, the current versions of the LaserWriter print driver will not only download font descriptions to the printer, but they will also swap them in and out of the printer's memory as needed. Earlier versions simply filled up the memory space, and then went into "overload" with a memory error and wouldn't print.

Version 5.2 of the LaserWriter driver, part of the System 6.0 package, will download a virtually unlimited number of typefaces to the LaserWriter, using a "swap-in, swap-out" procedure. Thus, you will no longer be limited by the amount of memory in the LaserWriter. More memory will increase the speed, however, when large numbers of fonts are to be used. Otherwise, expect to wait a bit.

Downloading takes time of course. Plan on an added ten to fifteen seconds per page for each downloaded typeface you have in your document. The extra time certainly isn't a problem if you're creating an attractive and useful document.

Of course, another problem in using downloadable typefaces is disk space. If you're using 3 1/2 inch disks, you can fill up disks with applications, fonts, and operating system software quite fast. Handling large numbers of typefaces will be much easier and more efficient from your computer's hard disk or from the LaserWriter NTX's hard disk.

If you're on a network, the downloaded typeface must be available in your computer's System file. There is a way to share common typefaces, however.

Olduvai's FontShare will look for the fonts on the network file server's hard disk, or any other attached computer you designate, and will automatically download it to the LaserWriter without tying up your Mac.

If you're running a publishing group, Olduvai's FontShare will allow all the networked Macs to share downloaded PostScript typeface files that reside on a central file-sharing hard disk, or the LaserWriter II NTX can be configured with one or more hard disks to store a large collection of type designs.

If memory is vital, perhaps you need to use a number of typefaces on a single page, or if you're using 3 1/2 inch disks, you can gain some space by using one of the font editing and design programs (described later) to remove all of the seldom used characters, especially many of the optional ones from your font files. You can trim as much as 25% from your fonts this way. If you need special characters, you can always access them in the Helvetica and Times typeface families.

What happens when your new font doesn't print, or it prints in a jagged, rough quality? Make certain that you have followed the installation instructions exactly. You probably didn't place the laser font files in the System folder as directed, and the printer went to the bit-mapped screen font and printed that instead.

After an automatically downloaded font has been used, it is eliminated from the LaserWriter's memory or font cache to make room for more typefaces that may be needed next. This seems rather innocent but has serious consequences for those people trying to create spoolers for laser printers that are able to download fonts. We'll see more about this in the next chapter.

Sources and Examples of Fonts

To attempt to represent every possible typeface that can be used on a LaserWriter is beyond the scope of this book. For example, even though you can print bit-mapped styles on a LaserWriter, the quality isn't up to the high standards one expects from such a printer. We'll therefore restrict our discussion to sources of PostScript-encoded typefaces that can be scaled, rotated, and modified in all the other fancy and wonderful ways that this powerful text and graphics manipulation language will allow. We don't intend to illustrate each typeface, because there are simply too many, and there are new ones being marketed each day.

Font Books and Catalogs

If you have a great deal of interest in typefaces for your LaserWriter, then you should be interested in the books *LaserSampler II* from MacTography, *The Font Buyer's Guide* from SourceNet, or *Desktop Publishing Type & Graphics* from Publishing Resources. These publications contain an extensive list of

available typefaces and illustrate each one in both upper and lower case for the entire alphabet, along with common punctuation marks. Keyboard maps, included in *LaserSampler II*, show the location of special characters accessed through the Option key, as well as the memory requirements for each typeface family. Mactography also sells the fonts shown in their book.

Heizer Software offers a HyperCard stack, Typefaces of Desktop Publishing, that includes over 800 typefaces, bit-mapped and PostScript, with source information, historical background, style variations, screen fonts, and a sample screen display. Publishing Resources also has a HyperCard stack of PostScript typefaces that includes technical information and usage suggestions.

A newsletter, *MiceType* from Alphabets Inc., may also be of interest to desktop publishers with an interest in learning more about typeface design and use.

This section is intended to give you an idea of the wealth of various typefaces that are available and to get you started on your hunt for just the right look you want. Many are extremely specialized foreign language, math, or scientific styles; others are decorative, attention-getting ones.

Of the two main varieties of type, text and display, there are, of course, wide areas of overlap. The following discussion will put typefaces into one or the other category, but this is an inexact science. A display face to one person is a text face to another. If you're interested in adding new and interesting typefaces to your system, contact the suppliers listed below for current listings and examples.

Most of the typefaces we will mention are designed for the Macintosh system. This is not surprising when you realize that the Mac has had at least a two year head start on the font craze. The IBM world will begin to develop new fonts now that PostScript has been officially endorsed. Look for many of these same suppliers to offer their typeface designs in MS-DOS format, too.

Text Typefaces

The Adobe Collection

The developers of PostScript, Adobe Systems, sell a variety of laser typeface families that are derived from well-known professional publishing designs. In addition to the typefaces you already have in your LaserWriter Plus or LaserWriter II, you can buy the following ones.

Serif typefaces include Corona, ITC Tiffany, Lucida, Stone Serif, ITC Lubalin Graph, ITC Garamond, Tiffany, Cooper Black, ITC American Typewriter, ITC Benguiat, Glypha, Trump Mediæval, Melior, ITC Galliard, ITC New Baskerville, ITC Korinna, ITC Cheltenham, ITC Friz Quadrata,

Goudy Old Style, Century Old Style, ITC Souvenir, Bodoni, University Roman, Stencil, Aachen, and Prestige Elite (another typewriter look-alike).

Sans serif typefaces include Optima, Helvetica Compressed, Helvetica Light, Helvetica Light Oblique, Helvetica Black, Helvetica Black Oblique, Helvetica Condensed, Univers, Univers Condensed, Futura 1 and 2, Stone Sans, Benguiat, ITC Franklin Gothic, ITC Lubalin Graph, News Gothic, ITC Machine, Hobo, Review, Letter Gothic, and Orator (these last two will remind you of typewriter print).

In addition, Adobe has Sonata, a font for printing sheet music, if that's your interest (if so, see Chapter Ten for music software that lets you print sheet music from the LaserWriters using the Sonata font), and Park Avenue, a script face used in printing invitations and the like. Other script faces are Freestyle-Script and BrushScript.

Compared with many other laser font suppliers, Adobe generally has more costly products, and many of its typestyles are based on professional typesetting designs by firms such as ITC and Allied Mergenthaler-Linotype. Adobe is currently creating digital PostScript versions from the entire Allied-Merganthaler collection of over 1,700 publishing typefaces.

All of the standard typefaces resident in the LaserWriter Plus and LaserWriter II models, as well as the ones listed above are now available in either Macintosh or IBM format, and Adobe is developing more PostScript typeface packages every month. This company's typefaces are of very high quality, and most are popular publishing typefaces.

Adobe also offers packages of typefaces that complement each other, that is, their designs are well suited to being used together. These "Publishing Packs" consist of typefaces selected especially for specific business applications. For example, the newletter pack consists of three typefaces: ITC Franklin Gothic, ITC Galliard, and Century Old Style. In addition, the packages contain "how to" booklets with tips and suggestions for each use. Buying typefaces such as Adobe Publishing Packs is more cost-effective than buying the typefaces separately.

Other Type Face Suppliers

Kingsley ATF Type Company also has translated many of its popular publishing typestyles (for example, Americana, Ultra Bodoni, Franklin Gothic, Spartan, and Cooper) into PostScript-compatible format for the Macintosh so that you may not have to give up your favorite typestyle when you convert to digital publishing. In addition, Letraset has the LetraStudio font library with 100 fonts, and a second collection is planned.

LaserWriter typefaces for the IBM-PC other than Adobe's are available from Bitstream, Inc. Its Fontware Typeface Library is available with installation kits for Microsoft Windows or for Xerox's Ventura Publisher using the GEM interface. Look-alikes for virtually all of the current LaserWriter II

typefaces are available and cost about the same as Adobe's. The entire series of LaserWriter Plus and II fonts are accessible from GEM/3.

Another approach is taken by Specific Fonts 3, from Specific Solutions, which allows access of the LaserWriter II typefaces (Century Schoolbook, Palatino, Bookman, and Avant Garde) from GEM applications. Image Club Graphics, Xiphias, ZSoft, and S. Anthony Studios also offer MS-DOS-compatible fonts.

General publishing fonts for the Apple II are available from S. Anthony Studios, and a Cyrillic Russian font can be obtained from Besearch Information Services. S. Anthony Studios also supplies fonts for the Commodore Amiga computer.

You can have some useful variations of the standard LaserWriter typefaces by installing Century Software's MicroFonts+. This add-on will create fat, thin, and very small point sizes from the standard Helvetica and Times faces.

Typefaces may be easily modified by using a draw program like MacDraw or SuperPaint. Just place the text and then import it into a page layout or word processing program. You will see small sizing handles on the text element which may then be pulled into stretched or tall shape. It can no longer be edited, however. If you must correct a spelling error, you'll have to go back again to your draw program.

There are other suppliers of high quality text typeface families for the LaserWriter. Devonian, for example, has LASERgenix: Riverside, a modern sans serif typeface, and Altsys Corporation offers several familiar typesetting designs converted to laser format. These include Goudy OldStyle and Goudy NewStyle, two very handsome publishing faces. They also offer Cooper, a crisp serif style, and two decorative sans serif faces, Venezia and Penstroke.

NeoScribe's Ambo and Garajon are clean serif bookfaces that will add a look of refined elegance to your work.

Image Club Graphics offers two serif text type designs, Liberty and Macntosh, and a sans serif style, Mechanical, which has a clean, modern, "computer" look to it. All of the Image Club Graphics font packages (and over 1,000 PostScript clip art images, too) are available on CD-ROM. This firm also sells CD-ROM drives for the Mac. Alphabets Inc. offers a serif face, Prospera, having a traditional "old world" look.

The traditional Bodoni serif typeface is available from CasadyWare, which also markets the sans serif styles Monterey and Micro, a modern face with a clean look.

Century Software is another laser type house with a wide variety of text styles. It has its own version of three sans serif ITC publishing fonts: Avant-Garde, Eras, and Kabel. Other sans serif faces include Neosho, Potomac, Willamette, Micron (with a modern digital look), Gothic, Option (a style similar to the well-known Optima typeface), and HelHeavy (a super-bold Helvetica

look-alike). Century Software's serif faces, Colorado, Columbia, and Yukon, are sharp and readable.

Allotype has several text faces, including Tempora, a serif face of upper and lower caps, and Haber and Thompson, sans serif and serif styles based on the LaserWriter's Helvetica and Times typestyles, respectively. The Haber and Thompson styles have a wide variety of optional characters from the Symbol font and eleven additional scientific notation characters. The Briar typeface from EmDash is a sans serif face that comes in a plain (roman) style, bold, and a heavy, ultrabold variety useful for lettering signs and the like. EmDash also offers Caspian, a serif face with a subtle calligraphic flavor. An even stronger calligraphic typeface design is Flourish from Electric Typographer.

Several new typefaces specifically designed for publishing have been developed by Zuzana Licko Design, including Matrix, a crisp serif face, and Berkeley, an artsy sans serif style.

Display Typefaces

Display faces are popular with desktop publishers for their distinctive appearance. They find particular use in headlines, charts, signs, and similar applications.

T/Maker Company's Laserletter Series consists of three different typefaces. Bombay is a sans serif oblique character set, Plymouth is a signboard-type letter, and Seville is a stylish, oblique serif face. Each typeface family comes in a halftone gray in addition to the regular styles.

Norfolk by NeoScribe is a highly condensed typeface designed for optimum appearance at sizes larger than 36 points. The ArtFonts Collection from Olduvai includes fanstasy typefaces for invitations, advertising, and logos, as well as business typestyles for newsletters, publications, and reports.

A heavy, block-style display type, BlackSanSerif, is available from Altsys Corporation, a supplier of font design and creation software. Image Club Graphics has a wide varity of display designs running the gamut from Surf, a script oblique typeface, to the aptly named Rubber Stamp. Image Club Graphics also has very decorative accent styles, including an Old English style called Castle.

CasadyWare has an Old English style, Gregorian, as well as a wide variety of script typefaces, including some very formal styles. Their Dorovar face has a Middle Eastern flavor, and their Gatsby and Ritz typefaces present an art deco look.

Century Software has a number of display styles, including Trent, an Old English style, and Rhine, a very Germanic face. Its Hudson face is art deco. Two smooth "paintbrushed" fonts, Architext and UpStart, are available from EmDash.

Two decorative typestyles, Abelard and Troubador, both based on hand lettering from the Middle Ages, are available from The Electric Typographer. These typestyles include a set of initial letters, each one based on a different flower, in a "block-print" design.

A stencil-looking display face, Cut Outs, is available from Software Complement, along with several others, including Nouveau, another art deco style.

Foreign Language Typeface Families

If your interest is in printing a foreign language on your LaserWriter, we've already discussed the great variety of foreign letters and accent marks that are available directly from the standard LaserWriter type families. The selection doesn't stop there, though. The Macintosh is the first personal computer specifically designed from the ground up to be international, and there are typefaces available for just about any language the world has to offer.

Several typeface suppliers offer foreign language fonts, but three of them, Linguists' Software, Eastern Language Systems, and Ecological Linguistics, are specialists in the field.

Among Linguists' Software's offerings are LaserHEBREW, a full-featured Hebrew font that works with the company's Achbar bidirectional English-Hebrew word processing software. These typefaces also work with other more familiar word processors for the Mac. Linguists' Software's LaserGREEK is a complete Greek serif typeface set along with English, French, and German alphabets and accenting symbols.

A Romance language set is also available from Linguists' Software. Its LaserFRENCH GERMAN SPANISH font set is a serif style that looks similar to Times Roman. This font collection is extremely rich and will support a great many alphabets including most of the middle European, Scandinavian, American Indian, and African ones.

Linguists' LaserCYRILLIC set produces Russian, Ukranian, Serbian, and Macedonian characters in most Macintosh word processing programs. For PC users, there's a Cyrillic Russian font available from Besearch Information Services.

Davka's Rav K'tav Hebrew Word Processor and MacKtav page layout software allow the mixing of Hebrew in right-to-left direction and left-to-right English. MacKtav is based on Letraset's Ready-Set-Go software. Both are also available in an Arabic version.

From Eastern Language Systems come specialized word processors for Urdu, Arabic, Persian, and Hebrew. LaserWriter typefaces are also available.

One of the other foreign typeface specialists, Ecological Linguistics, offers EuropeanTimes, a collection that covers all the Roman alphabets of continental Europe using the Times serif typeface. Using this font in conjunction with

the Caps Lock key, you are given access to a wide variety of accented characters rather than the standard engineering characters present in the LaserWriter's built-in Times font. Greek, Cyrillic, Southeast and Central Asian, North and South Indian, and Turkish typeface collections are also available.

The Japanese and Chinese languages, of course, are extremely complex, and the Macintosh/LaserWriter combination, with its high resolution screen and excellent printing quality, is well suited for this demanding task. A Japanese language word processor, E/G Word, is available from Qualitas Trading Company, which handles 3,000 Kanji characters but can also be used for English language word processing. Its E/G Bridge allows direct input of Japanese characters into standard Macintosh application software. A Chinese word processor, FeiMa, is available from Unisources Software.

Among other foreign typeface offerings is LASERgenix:Sverdlovsk from Devonian International Software. This is a serif design which includes Cyrillic and modified Cyrillic characters suitable for printing Russian, Old Russian, Serbian, Ukranian, Byelorussian, Macedonian, and a number of Turkish and Asiatic languages.

NeoScribe offers a Hebrew design, a Devanagari alphabet typeface family for Sanskrit and Hindi, a modern Greek typeface, and Phonique, a complete set of International Phonetic Association symbols.

CasadyWare has a Russian language typeface, and Greek and Polish designs are available from Allotype Typographics.

A Greek word processor, GreeKeys, is available from SMK, along with their Attika Greek typeface.

The Institute of Typographical Research has developed a number of Middle and Far Eastern PostScript typefaces, including Arabic, Thai, Tibetan, and Indian styles.

Finally, there are a variety of special purpose and decorative typefaces in PostScript form.

Special Purpose Typefaces

NeoScribe's OCR-A is specifically designed to print the computer-readable characters used with optical character recognition (OCR) scanners. In addition, Software Complement offers a software package for printing bar codes.

Among the handier special purpose type designs is Bullets & Boxes from Casey's Page Mill. This selection includes bullets of various sizes along with a variety of empty boxes and boxes filled with decorative patterns, as well as triangles and hexagons that are especially useful for designing forms having check boxes. For software manual writers still using a Mac Plus, even the illusive Macintosh Command key symbol is here. A similar set is available from Emdash. For Mac SE and II users (i.e. users of any Mac with the 256K ROMs), the cloverleaf Command key symbol is obtained in a document by pressing Control-Q; the Apple logo is Control-T and the check mark is

Control-R. If you have a Mac Plus or 512K, you can access these symbols by using the public domain program "Laser Quotes," which is available from most user groups.

Specifically designed for creating Macintosh documentation is PIXymbols-Keys from Page Studio Graphics, which contains the entire line of Macintosh keyboard configurations in pictorial representation.

The Chemistry Is Right

Chemists will find Allotype's Structure and Modern Graphics' Chemical Fonts useful. These are true fonts and, as such, are line-oriented just like any text character. This may detract from their use in word processors, but the various chemical symbol characters can be moved around and joined in programs such as MacDraw. The Allotype font is in PostScript format, whereas Modern's is bit-mapped. Even more useful for chemists is Modern Graphics' DrawStructures, a template of predrawn chemical structures for use in object-oriented programs such as SuperPaint and MacDraw.

Perhaps the best solution to creating chemical structures for inclusion in documents is SoftShell's Chemintosh DA, a MacDraw-like desk accessory that has a pallette of chemical bonds, rings, and other structural elements instead of the typical rectangles, arcs, and ovals seen in MacDraw. It is well designed, simple to use, and the output is of very high quality.

For Mathematicians

Although not technically a typeface, Expressionist from Allan Bonadio Associates is a desk accessory that uses the LaserWriter's Symbol type family, along with any of the other text faces, to create complex mathematical equations that can be added to documents created by any Mac word processor. If math is your thing, this will print just about any equation in beautiful quality on your LaserWriter.

Three other math equation programs that will prove useful in formatting complex equations are MathWriter from Cooke Publications, MacΣqn from Software for Recognition Technologies, and MathType from Design Science.

For PC users, there's The Egg from Peregrine Falcon Company, a word processor and specialized typeface collection that allows complex mathematical equations and chemical structures to be prepared and printed on the Apple LaserWriters.

Lots of Odds and Ends

Fancy borders can add just the right look to less formal designs, and you can have just the look you want with Border Fonts from Altsys, Framework Fonts Series 1 and 2 from Computer Productions Unlimited, or Bodettes Borders from Software Complement.

Real Macintosh fans will remember the Taliesin and Cairo fonts that came with early Macs. These are graphic symbol designs running the gamut from

whimsical to serious: dogs, handicap and no smoking symbols, stars, arrows, cocktail glasses, and just about everything else. Although they were ImageWriter fonts, you can still have them. Century Software has converted them into laser format as Symbols+.

Zuzana Licko Design offers two sets of typographic icons representing travel, transportation and service symbols for airports, hotels, coffee shops, parking, first aid, customs, cocktails, repair service, and babysitting, to name only a few. You can add the familiar credit card symbols for American Express, Visa and MasterCard by using the LaserLogo Credit Card Symbol Font from GM/GP. Adobe also has Carta, a graphic font useful for mapmaking and other cartographic applications.

The PIXymbol sets from Page Studio Graphics are pictorial symbol designs relating to basic in-house newsletter topics (activities, events, holidays, etc.) and helpful for illustrating business communications. A collection of arrows in various designs is available from Emdash.

Alphabets Inc. offers MacWoodtype, a series of nineteenth century designs, and MacStamp, a collection of woodcut images from the Baroque and Renaissance eras.

Special Effects and Custom Designs

Special effects with type could be just what your newsletter or brochure might be needing. Century Software's Shadow Effects and Shadow Effects 2 take the familiar Times and Helvetica styles and print them in patterns of gray, filled with starburst lines and other patterns or reflected in mirror image.

Cricket Draw and Postcraft's LaserFX take normal typefaces and allow you to rotate, skew, or shade them, and add multiple shadows and outlines to them in order to create very unusual and dramatic effects with laser type. If you're using Ventura Publisher on the PC, Corel System's Newfont will do many of these PostScript effects. Letraset's LetraStudio software will also allow manipulation of typefaces.

Do you need a special type design that you just can't find (a company logo, for example)? Well, Image Club Graphics has a custom design service, and the prices are reasonable. GM/GP, ByteSize Graphics, NeoScribe, and Casey's Page Mill also convert logos into PostScript outlines and bit-mapped screen fonts.

Where Are They?

Finally, there's the problem of remembering where all the various special characters are in each of these typeface families. The handy Key Caps desk accessory is especially useful when you have a large full-page monitor. Just keep your application window slightly smaller, leaving enough room for the Key Caps window to show below, after setting the Key Caps menu to display the correct font. If your monitor is like the Radius screen and leaves the

built-in Mac Plus or SE monitor active, then placing the Key Caps window on the Mac screen will allow you to keep the entire full page monitor dedicated to your main task (Figure 6.1).

You can also print each of the Key Caps layouts using a public domain desk accessory called Camera. It should be available from your local user's group or can be ordered from either the Boston Computer Society or Educomp.

Designing Your Own

If the wonderful richness of all these typeface designs isn't enough for you, you can design your own. There are several font editor programs that may be used to design and create your own special fonts. Even if you don't consider yourself a type designer, there's a lot that you can do with one of these programs.

Have you ever looked at your typefaces or fonts using Key Caps? You'll generally find that there are quite a few empty characters, especially if you press Option and Shift-Option. They're shown by all the empty boxes. You can design special characters to fit these empty places, which is especially

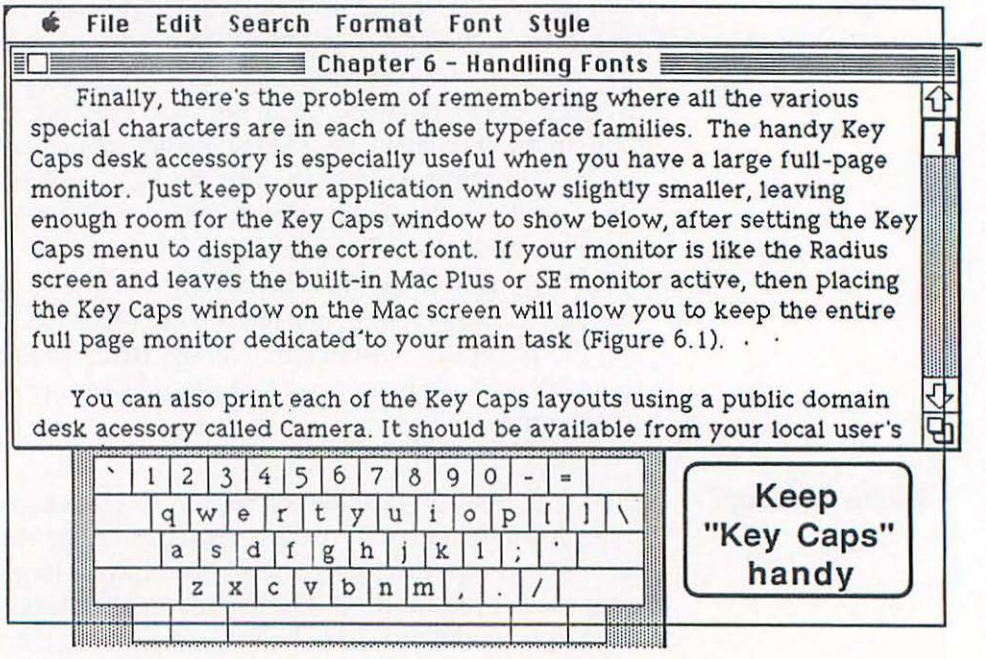


Figure 6.1. Screen Image: If you need to refer to Key Caps often, keep it on-screen.

useful if you work in a highly specialized field that has a special character or two that you just can't seem to find anywhere else, or if you want to add your company logo. It's not that difficult; with some programs, you can even use scanned-in art as a drawing template.

Of course, typeface design is an art. Preparing digital typefaces takes a healthy combination of art with a good structured sense of mathematics. If microcomputer type design is of interest to you, consider subscribing to the newsletter *MiceType* from Alphabets Inc. (804 Dempster St., Evanston, IL 60602).

All these things are yours if you want them. You don't have to create new type designs from scratch; you can always edit existing ones to enhance them to suit your needs perfectly.

There is one thing you can't do, however. The typefaces that are built into the LaserWriter are not editable; they're encrypted to prevent their alteration.

Remember, though, that you'll actually be designing and creating *two* different fonts. One will be a PostScript outline typeface; the other a bit-mapped screen font in specific sizes. Since it is a PostScript design, you will be able to scale it to the size you wish and then print in LaserWriter quality, or send it to a PostScript typesetter for reproduction in ultra-high quality.

Perhaps the most familiar font editing programs for the Macintosh are those from Altsys: Fontographer, the laser font program, and FONTastic, which is used to prepare the corresponding bit-mapped screen font automatically from the laser font. The latter may be used alone to prepare ImageWriter fonts.

LaserWorks by LaserWare is another PostScript typeface creation and editing program for the Macintosh. Zsoft's Publisher's Type Foundry is a PC-compatible font creation program.

Outline typeface designs can also be created for the IBM-PC using Fontware from Bitstream Inc., a major type design house.

In addition, you can convert many of the third party typefaces for the Macintosh into a form that will work on the IBM-PC. You must start with the font file on a Mac and use a disk file edit program such as Apple's ResEdit or MacMaster's FEdit to change the File Type from LWFN to TEXT. Then the font file may be edited on the Mac or sent to the PC and edited there by using any text editor or word processor. *Technical Note No. 1*, a bulletin from Altsys Corporation, describes the rest of the procedure. Of course, with the increasing popularity of the IBM-PC as a desktop publishing tool, there will be more fonts available for it in the future.

All these programs basically involve tracing an outline shape and then refining it carefully to the exact shape you wish. You'll have lots of options, too, including what you want to fill the character with—black, white, or a shade of gray, perhaps.

Any character designed with these programs is a PostScript image and can be scaled to various sizes. Your company logo could thus be placed in a 48-point size with the company name and address in a smaller size.

Of course, you'll have to have a Font ID number for your creation. The programs select one for you, but also give you the option to choose a different one in case there are conflicts. Some Font ID numbers should be avoided at all costs. They are the basic System fonts: Chicago (ID=0), Geneva (ID=3), Monaco (ID=4), the MacPaint font (ID=249), FullPaint (ID=250), and the MacDraw fonts (ID=254). Using any of these will crash the program you're using.

There are plenty of high quality typefaces that you can buy to add to your collection, but don't let that keep you from being your own type and logo designer. You'll have an individual power over the look of your documents that Gutenberg would have envied.

CHAPTER **SEVEN**

Getting the Best Text Out of Your LaserWriter

Text into Type

Going "Full Menus"

Great Text from Average Programs

Paper and Paperfeeding

The Apple LaserWriters are certainly the highest quality computer printers small enough to fit conveniently on a desktop. To get this high print quality, they pack as many as 90 thousand individual dots in a square inch. You probably think the Macintosh screen is clear and crisp, but it uses only about 5 thousand dots in the same space.

More importantly, the LaserWriters are PostScript printers. PostScript allows very high quality text printing. (We'll see why a bit later.) Even with all this high powered printing technology, there are ways to assure that your work wrings the best it can from the LaserWriter. Here's how.

Text into Type

The truly exciting thing about the LaserWriters is their ability to print professional typefaces, called *fonts* in the Macintosh world, as we have mentioned in earlier chapters. But to print such typefaces, you must use a "laser" font such as Times Roman or Helvetica, which is stored in PostScript form within the LaserWriter, or you must use a font that can be downloaded from the computer or attached hard disk.

Although the Macintosh seems to deal with fonts in a very specific manner, there has been a marked evolution in font handling as the Mac and many of its applications, especially desktop publishing, have matured.

Originally, the Mac, following the lead of the earlier Lisa computer, was designed to have interesting typefaces in a large number of sizes which were going to be shown on a crisp screen resolution of 72 dots per inch. These typefaces would then be printed out from Apple's new ImageWriter in a very close representation of what you saw on the screen.

At this early stage, Macintosh designers were thinking only in terms of "quasi-typography" with a variety of proportional typefaces in a number of styles and sizes. Text prepared from these proportional typefaces looked much better than text from other computers. Each letter had its own width, which makes the printing look much more pleasing and professional, but real desktop publishing, with its strict adherence to the conventions of typography, was to come later.

Because of limited adherence to the standards of typography, the original Mac was designed to optimize the appearance of the screen fonts and their ImageWriter output. At the time, this was a great improvement over traditional computers, such as the IBM-PC or Apple II, whose typefaces were based on a single, monospaced character font. The Mac brought pizazz to

computer-created documents, but still fell short of strict typography. For example, the Mac used a capability built into the operating system to mathematically derive the other styles such as bold, italic, shadow, etc., from the *plain* or *roman* fonts. Traditional typography uses separate designs for these.

Enter the LaserWriter

With the advent of PostScript typefaces and the vastly increased LaserWriter resolution, new screen fonts were designed to mimic the PostScript faces.

In addition, the original 64K Mac ROM had to be changed. It moved typefaces horizontally in increments of a full screen pixel, $1/72$ of an inch, which was too coarse to achieve typographic accuracy. Indeed, printing from this early Mac system usually resulted in characters spaced too closely, giving a "jammed-together" appearance. The most faithful and accurate printing will thus come from Macs that contain the newer 128K and 256K ROMs. These include the 512KE, Mac Plus, Mac SE, and Mac II.

To be able to use the high quality PostScript fonts, you must install the appropriate screen fonts so they show on the Font menu in the program you are using.

If you use a standard font intended for Apple's dot matrix Imagewriter printer, such as Geneva or New York, don't expect it to be high quality when it prints from the LaserWriter. These Imagewriter fonts can't take advantage of the high resolution of the laser printer and won't look much better than they do from your ImageWriter. They simply print the same way as they do on an ImageWriter—complete with rough, jagged edges, unless you have selected Font Substitution on the Print Menu. Allowing Font Substitution to be checked will substitute a PostScript laser font into the printed document in place of the ImageWriter font, but spacing won't be optimum even then.

The Perils of Font Substitution

In Figure 7.1, the text has been prepared with an ImageWriter font for the first example and a LaserWriter font for the second. Then Font Substitution was allowed to put the LaserWriter printing font in the ImageWriter font's place. You can easily see why you want to avoid this. Both lines beginning,

Printed from a document created with New York font:

ImageWriter typefaces carry different inter-letter spacing than LaserWriter typefaces.

Printed from a document created with Times Roman font:

ImageWriter typefaces carry different inter-letter spacing than LaserWriter typefaces.

Figure 7.1. Text: Creating your document with PostScript typefaces gives the best text appearance.

"ImageWriter typefaces ..." were created in 14-point size, but they print quite differently. The character sizes and the letter spacing are quite dissimilar.

This switch from ImageWriter fonts to PostScript LaserWriter typestyles added several new problems for Macintosh system designers. The screen is divided into 72 spaces per inch, and the LaserWriter can distinguish up to 300 dots per inch, which means that the screen is limited in moving characters back and forth to achieve changes in letter spacing. Because the screen uses somewhat larger intervals than the LaserWriter is capable of using, it can't represent the resulting printed copy exactly.

In addition, the Macintosh screen image gets its character spacing information from the System file in order to determine exactly where to place each character in a line of text, which is not the case with the LaserWriter, however. It derives character spacing from special character width formulas stored within the printer's ROM. Downloaded laser fonts come with their own width descriptions.

Screen images therefore show characters, words, and lines, all having a certain length, but, the LaserWriter prints a slightly different length. Screen images can be quite close in appearance to LaserWriter output, but they won't often be exact replicas.

The text that results from this discrepancy between the screen image and the laser printout generally has shorter, more closely packed lines. The reason for this is that the LaserWriter adheres to the exact line breaks that appear on the screen, even if the printer could squeeze an extra word on the line. Thus, the laser printout sometimes has lines shorter than those of the screen image.

If that were all, the solution might be fairly simple. One would simply set the right margin slightly wider to adjust for the difference, but there's more to the problem. There's the software.

In addition to the Mac's generation of the screen display, most software has its own mathematical formula for fitting text onto a line. As a result, you may see a difference in both the screen image and the printed output of the same text from different programs such as MacWrite, Microsoft Word, and PageMaker.

MacWrite programs (versions 4.5 and earlier) were particularly inaccurate when their rulers were used to format documents for printing on the LaserWriter. The latest versions have been improved.

Going "Full Menus"

There's a third complicating factor, too. We've mentioned that the Mac derives its screen font style variations by using a QuickDraw mathematical routine stored in the System file. It takes the plain (roman) font and mathematically boldsfaces it when you click on the "bold" Style menu. This boldfac-

ing factor is the same for every character in a typeface family. Yet because it is the same factor for a wide letter like *m* and a narrow one like *i*, another divergence from traditional typographic design is created.

Typographic designers always try to achieve the most pleasing appearance in their typefaces. This can virtually never be done if the amount of character spacing is the same when letters are boldfaced. Consequently, the Mac diverges even farther from typographic standards when you go to a bold style. There is a way around this, however.

Getting the Right Screen Fonts

The screen fonts supplied with your LaserWriter by Apple contain the plain (roman) font only. The other styles—bold, italic, and bold-italic—are created mathematically by the Mac's system software with its attendant problems.

The actual screen fonts for bold, italic, and bold-italic styles for most of the PostScript typefaces are available from Adobe Systems for a relatively modest cost, or they may be downloaded from CompuServe. There they are listed in the Adobe Forum under Data Library 6 after typing `Go Adobe`. When these true screen fonts are installed, they appear individually in your Font menu. So, rather than one font showing for a single typeface family, you will have four.

For example, when you install the complete Times family of screen fonts, you will see "Times," "B Times Bold," "BI Times Bold Italic," and "I Times Italic" listed on the Font menu. You can choose these text styles by using the specific typestyles shown in the Font menu rather than generating them from the plain version of Times by using the Style menu, but if you later wish to change typefaces to Helvetica, for example, you will lose the bold or italic styles as a result. Because of this, you may wish to select styles from the Style menu so that the characters retain their style information even when typefaces or fonts are changed.

If you are serious about desktop publishing, you should investigate using these full sets of screen font styles instead of relying on the single style supplied with your LaserWriter. The appearance of your printed output will be improved. In addition, be sure to install a complete set of the same sizes of screen fonts that you already have as plain fonts.

The full sets of screen font styles will take lots of disk space, however. Plan on 1.2 megabytes for the entire set of LaserWriter Plus and LaserWriter II fonts—a hard disk is therefore a must. You don't have to install all of them, however, but you do need to install the ones in the point sizes that you plan to use.

PageMaker Does It Differently

Before we go on to other ways to improve the appearance of text, let's consider what the people at Aldus did to improve matters when they designed PageMaker.

If you're already using PageMaker, you have no doubt noticed that this software requires a special LaserWriter program called AldusPrep instead of Apple's LaserPrep. With AldusPrep, PageMaker does its own calculations of what fits on a line of text. In short, it overrides the character spacing that has preceded it from other programs.

For example, if you input text from MacWrite or Microsoft Word, you will find that lines of text, especially bold or shadow text, print out more compactly in shorter lines than when printed directly from the originating program. This would be a problem for entire sections set in bold or shadow because line lengths would be too short when printed from PageMaker. One rarely uses these styles for large blocks of text, however. Headlines are the most likely use and, as a result, you may find that large type in these styles printed from PageMaker appears more pleasing to the eye than large type from most word processing programs.

Make certain, however, that you use exactly the same versions of System, LaserWriter, and AldusPrep for creating and printing the document in order to maintain the best letter spacing possible.

If you plan to send your file for printing on a Linotronic typesetter, confirm that you have used the same version of AldusPrep that the typesetting service is using. Some will even supply a copy of their System files.

If that isn't possible, you can play it safe by creating a pure PostScript file from your document by pulling down your Print menu, clicking OK or pressing the Return key followed by Command-F. The message on the screen should then say, "Creating PostScript™ file." This file now contains the data in PostScript format and can be readily used by typesetting bureaus equipped with PostScript phototypesetters like the Allied Linotronic models (Figure 7.2).

New ROMs Are Better, Too

Apple has attempted to overcome some of these spacing problems. The 128K ROM in the Macintosh 512E and Plus models and the 256K ROM in the Mac SE and Mac II have the ability to use much finer letter spacing than the original 64K ROMs.

These new enhanced ROMs allow screen character widths to be matched much more closely to the very precise widths contained in the LaserWriter. This improved character placement will result in better looking printouts.

To do this, however, your software must be designed to tap this special feature. New versions of Microsoft Word, Write/Now, WordPerfect, Adobe Illustrator, Aldus PageMaker, Quark's Xpress, and Cricket Software's Cricket Draw allow the use of such fractional letter spacing routines. Look for this enhanced feature to appear in most new versions of page layout and full-featured word processing software.

T-Maker's WriteNow word processing software has an option in the Page Setup menu for a Use Printer Spacing feature that creates screen spacing

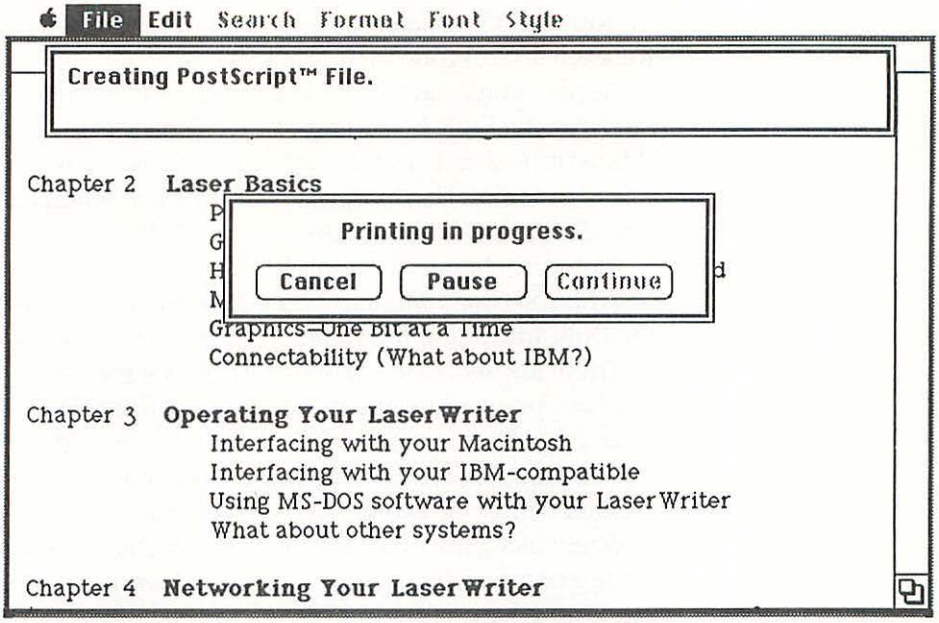


Figure 7.2. Screen image: Creating a PostScript-based file from a Macintosh application.

equivalent to the printer's spacing so that plain and bold letters are the same width, which is a very useful feature for assuring the best text quality. Microsoft Word 3.02 (and later versions) and WordPerfect 1.0 offer a Fractional Width option that utilizes the LaserWriter's spacing for improved text appearance.

Note, however, that you may sacrifice a bit of the appearance of the screen display in order to gain from better letter spacing coming from the LaserWriter printout. Because of the approximations and rounding used in creating the screen widths, some characters will look squeezed together on the screen while others will appear farther apart.

For large typeface sizes, the letters will look better if they are kerned together slightly. Many page layout packages will do this, but one stand-alone program, LetrTuck from Edco Services, allows you to modify the letter spacing and save the values to the font's existing kerning table. Improvements in text spacing will be carried through on any PostScript device, including the ultra-high quality Allied Linotronic imagesetters.

Mixing Fonts Can Cause Problems

Another problem related to Macintosh screen fonts could at times give you difficulties. Mixing fonts may lead to having different amounts of line spacing, or leading on a page. Mac screen fonts have their own amount of leading built-in. There is usually at least one row of blank pixels or screen dots

on top of each character, but it's not necessarily the same exact pixel height for each screen font.

Applications that allow the leading to be changed will add or subtract leading from the built-in leading of each font. If two fonts are on a line and have different built-in leading, then leading added by your application will yield uneven results. This is a particular problem when adding the Symbol font to one of the standard text fonts (Figure 7.3).

Can you change the built-in leading so that it's uniform between fonts? Yes. Simply use a bit-map font editor such as Fontastic from Altsys to make the built-in leading the same on all the screen fonts.

There are also cases in which Apple's screen fonts don't match those from Adobe. For example, the Palatino screen fonts that come with the LaserWriter Plus have two points of leading built-in. Adobe's screen fonts for its downloadable version of Palatino have only one point of leading. Thus files created using one screen font will have a different leading when printed on a system using the other screen font, which is another reason to supply laser-setting or typesetting services with your entire system file or to use one supplied by them.

Great Text from Average Programs

Other text printing problems occur because of software limitations. Text placed in MacPaint documents, for example, prints out with a rough, jagged appearance even from the LaserWriter. MacPaint is a bit-mapped program and, as such, will print out in the lower quality dot resolution of the Macintosh screen. Any text placed in MacPaint will be only as good as the Macintosh screen, even when it is printed out on your LaserWriter, because MacPaint essentially prints a screen image to whatever printer it's using.

All is not lost, however. You can have clear, crisp text and your fancy MacPaint drawing, too, but you'll need extra software. Create your painting using MacPaint just for the graphics, and then place it into a page layout program

There are also a few typestyles that have a slightly different amount of leading even though you specify the same point size. For example, characters in the Symbol font carry a taller profile including a blank leading space between lines. Thus line spacing will look taller when a Symbol character like α is placed in a line of text. The line above contains a Symbol font character which has created an uneven line spacing or leading. Blocks of text will appear uneven when Symbol font characters are included. This will also happen when other fonts having different amounts of leading included in the character heights are used.

Figure 7.3. Text: Some typefaces carry amounts of leading that can throw line spacing off.

such as Aldus' PageMaker or Letraset's Ready-Set-Go, where high quality text can then be added, or simply copy your MacPaint masterpiece into MacDraw and add the text there using a LaserWriter font.

Some of the more fully featured graphics programs such as SuperPaint from Silicon Beach Software may be better for you if you need the ability to create bit-mapped graphics and add high quality text. SuperPaint is a useful hybrid program that combines two layers: a bit-mapped graphics mode similar to MacPaint and a structured drawing mode that works like MacDraw. By creating the graphics in the "paint" mode, you can then add high quality text under the "draw" mode. The text then prints in excellent quality.

When Fonts Have the "Jaggies"

If you get uneven, jagged fonts even from a program like MacWrite or Microsoft Word, make certain that you have installed the fonts from the latest LaserWriter font disk. Install the entire set using the latest version of the Font/DA Mover. Then check that you have the most recent LaserWriter, LaserPrep, System, and Finder files on your start-up disk.

When you use different Macintoshes, also make certain that each has the same version of System and Finder files. This will eliminate the subtle screen and print differences that can result from using different versions of the operating system software. It is also wise to make certain that the same version of the LaserWriter and LaserPrep are being used.

You may also run into the problem of font-switching when you have added non-Apple fonts to your System. If two have the same Font ID Number, you shouldn't be in for trouble; the Font/DA Mover should renumber them automatically, or you can do it yourself with Font/DA Juggler Plus from ALSoft. However, you can get the wrong font printing out when you move to another System. A responsible font supplier should indicate the Font ID Number in its documentation so that you at least have the possibility to avoid problems before they happen.

MacDraw's Little Font Problems

Moving MacDraw documents between computers can also be a confusing source of font switching. MacDraw, unlike most other Mac software, keeps track of which font goes where by the order in which the fonts were originally installed in the System file used when the MacDraw file was created. It doesn't sit there and think, "Yes, this person means for Helvetica to be right here." No, clicking on Helvetica in the MacDraw Font Menu just attaches the installation number with the text. It thinks, "This person wants Font Number Three right here." The Macintosh down the hall may have had Zapf Dingbats installed as the third font. Look out!

While we're talking about MacDraw, here's how to increase the number of possible font sizes: Type the text in Microsoft Word, or in another word

processor that allows font scaling (MacWrite doesn't), and import it into MacDraw through the clipboard. This can often get you the exact typesize you want, even when a program doesn't support font scaling.

Getting clear, readable reverse (white on black) type in small point size from MacDraw can be troublesome, too. Try placing text in double the required size using the "outline" style and place it on a black-filled background. Then print from the LaserWriter using a 50 percent reduction.

Getting the Most WYSIWYG

To achieve the best correlation between what is seen on the screen and what prints from the LaserWriter, you should create each document specifically set up for the LaserWriter, because the difference between the page margins the software creates depends on whether the ImageWriter or LaserWriter is selected as the printer of choice.

Before preparing text documents for later printing on the LaserWriter, make sure you have the LaserWriter file in the System folder and that AppleTalk is shown as connected on the Control Panel, and LaserWriter is selected in the Chooser before beginning. The Page Setup menu will then adhere to the LaserWriter margins rather than the ImageWriter margins.

With MacWrite, this still may not do the trick. If this is the case, use the margins that are suitable for printing on the ImageWriter and reduce them to 90 to 95 percent when printing from the LaserWriter.

You may also find that printed text that appeared indented or lined up correctly as columns on screen prints misaligned. This can be avoided by using the Tab key to indent, or line things up, rather than the old "typewriter method" of pressing the spacebar until things look lined up.

Remember, most fonts on the Macintosh and LaserWriter are proportional: that is, some letters are wider than others. You never had to worry about this when you used a typewriter or a monospaced character font on an IBM or Apple II computer, but now you must change your ways and begin using tabs to align text.

Don't forget that the best text appearance comes from using a LaserWriter font like Helvetica, rather than using its ImageWriter equivalent Geneva and then allowing the Font Substitution on the Print menu to replace Geneva with Helvetica.

Additionally, you will find the spacing between bold or italic characters slightly wider when you use either an original Macintosh 512K that has not been upgraded to the 512KE or Mac Plus by adding the 128K ROM chip. The older 64K ROM produced these styles in a wider form than the newer 128K and 256K ROMs.

Remember, too, that some typeface families, like Symbol, have a different character height because of a difference in degree of leading. If you wish to maintain the same leading throughout a section containing a Symbol charac-

ter, simply select a blank space between two words in each line that doesn't contain a Symbol character and change the selected space to the Symbol font. This adds the Symbol leading to all the other lines. It's not elegant, but it works. A better way is to use a page layout program that allows line-by-line leading.

You Can Help, Too

Not every problem in getting the best looking text from the LaserWriter is related to hardware or software. Sometimes it's the person at the keyboard. While a treatise on style and design is well beyond the scope and intent of this book, such issues should be a concern to every user of equipment that does, after all, have a potential for tasteless abuse. Most of us were brought up on the thin broth of typewriters and regular (dull) computers. It helps when you know what looks and reads best. Here are a few design tips.

First, except for Courier, all of the typeface families or fonts used on the LaserWriter are proportional, including the blank space that follows the period at the end of each sentence. You are probably used to adding two spaces at the end of each sentence, which is what is needed on typewriter keyboards where most of us have learned to type. With proportional fonts you really need only one blank space separating each sentence, especially if you are using full justification. Try it and see how much better your work looks. It will appear more typeset. Also, when using a minus sign with numbers, use the correct typographic length for a minus sign, which is obtained by using Option-dash.

Furthermore, professional typographers and graphic designers know that long lines of text are more readable with a point or two of extra leading added.

Special characters also add a lot of professionalism to your work, but you'll want to use them correctly. The handy Register (®) and Trademark (™) characters will be less distracting if you set them in a point size smaller than the rest of the text. Although the PostScript fonts used with the Macintosh do not place the Register mark above the word it modifies, you may wish to superscript this mark because it is conventionally displayed in such a manner. These marks should also be used in a sans serif typeface family such as Helvetica when they are placed in sizes under ten points so that readability is maintained. Superscripts and subscripts should also be used in a point size smaller than that used for the blocks of text. Some programs reduce their size automatically. Keep these suggestions in mind when you use superscripts or subscripts in chemical formulas, math equations, and the like.

Making Your Work Easier to Read

Before printing from programs lacking an automatic hyphenation and justification routine, such as MacWrite, go through and look for long words that have "word-wrapped" to the next line leaving either a gaping hole in the ragged right margin or very wide word spacing in justified text. Breaking long

words by adding hyphens followed by a space will help even up the lines and words. Generally, however, avoid fully justified text in routine documents. You may think such justification looks more professional but it is actually more difficult to read.

Large blocks of bold and italic styles, flush right/ragged left text, and text set in all capital letters are also difficult to read. In fact, a text in lower case is read 13.4 percent faster than a text printed in all capital letters. Remember this when you are composing a headline. Very short or very long line lengths also impede readability.

Text in reverse—that is, white type on a black background—is fine for emphasis when this is needed, but, avoid it when you use larger blocks of type. It's ten percent slower for your readers, who may not even bother reading such a format.

If you require small typesizes, look for a sans serif style, preferably in a condensed version such as Helvetica Narrow.

You will also note from your own reading that body text is often set in a serif face while the text's headlines appear in sans serif. This isn't a hard and fast rule, but it is a familiar sequence for most readers. Avoid using too many typefaces, however, since such design tends to add clutter.

Stretching Type for Emphasis

If you need a large type size, one larger than your software will create directly, here is one solution. Try making the headline in MacDraw, copy to the Clipboard, paste into MacWrite or any other word processor, and then use the "handles" to enlarge the headline graphic to the size needed (Figure 7.4). This is also an excellent way to stretch type or to compress it. Headlines can be created using MacDraw and then stretched or squeezed after placing in a document. The printed results are shown in Figure 7.5.

You can also stretch or compress type directly from within PageMaker using SuperGlue software from Solutions Inc. First, set the headline copy in PageMaker using automatic kerning and a customized leading. Then use the Print command to create a graphic object from the text. Copy and paste the graphic object back into PageMaker with the included SuperViewer desk accessory. You can then enlarge, shrink, stretch, or squeeze the headline as desired. In Ready, Set, Go, simply copy the prepared text into a graphic block and then resize it as you wish.

Using an object-oriented desk accessory graphics program such as Deneba's Canvas or the shareware program Juggler (available from Educomp or a user group) also allows you to create headline type in the draw format and then paste it through the Clipboard and stretch.

Using "Famous Quotations"

Your work will also appear more professional when you use the true typographic symbols available in most PostScript typefaces, especially the curved quotation marks, bullets, and the em and en dashes discussed in the

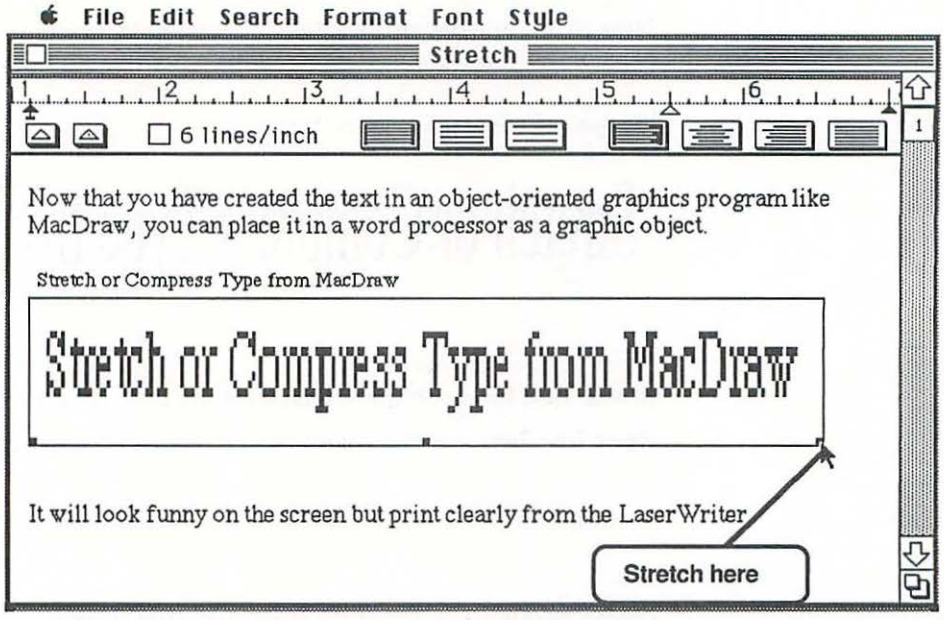


Figure 7.4. Screen image: Stretching or compressing type from MacDraw or a similar application keeps the high quality.

previous chapter. You may find that you forget to use them at times. If so, then a public domain program called OverWood or "LaserQuotes" removes extra spaces, changes all the quotation marks and apostrophes to the curly typeset versions, and modifies all the hyphens for you. Ashton-Tate's FullWrite Professional for the Mac substitutes curly typographic-style quotes automatically if you set the substitution in the Preferences menu.

A shareware program called Macify does all this and even more, including the creation of ligature pairs and the substitution of single spaces after each sentence (when you are still entering two spaces as you were taught to do when typing). Also note that PageMaker in versions 2.0 or higher can automatically substitute curly quotation marks for the straight up-and-down kind.

Scanning Text In

The Mac and LaserWriter are great for printing out very attractive text. But what if you need to get text in, first? In Chapter Three we talked about moving MS-DOS and other files into the Mac, but what happens when you're stuck with hundreds of documents from a closed proprietary word processing system, and you dread reentering all that text?

There's an alternative—an OCR (optical character recognition) scanner. For a few thousand dollars, you can have a scanner that will read in text and act as a graphics scanner, too. You can also use a graphics scanner with Ol-

Now that you have created the text in an object-oriented graphics program like MacDraw, you can place it in a word processor as a graphic object.

Stretch or Compress Type from MacDraw

It will look funny on the screen but print clearly from the LaserWriter.

Figure 7.5. Text: The stretching gives you a special effect and the printed quality remains high.

duvai Software's Read-It! software that recognizes typeset fonts from magazines, books, or laser printed documents. This software comes in two forms: one for Thunderscan and another that will work with all the other scanners. We'll talk about scanners and scanned graphics in the next chapter, but for now, several models, including Dest's Scan Plus, Datacopy's Jet Reader, and New Image's MacScan have software available that will scan text and convert it into ASCII text characters for inclusion into a word processing document.

Before fully committing to a text scanner, however, make certain that it can read the input document's typestyle accurately. Some scanners are rather limited in the number of typefaces they recognize and may have difficulty reading proportional type; others have a learning mode in which you can teach it to recognize new typefaces. Typewriter print and daisywheel print are the easiest fonts for most models. Dest's Publish Pac OCR software formats scanned text in MacWrite, complete with margins, tabs, and indents. It also scans text and graphics from the same input page, keeping each separate as text characters and graphics, respectively.

Paper and Paperfeeding

We already know that the actual printing technique used in the LaserWriters follows the photocopying process very closely, so it's not surprising that good printing results are obtained using the very same kind of paper used in your photocopier. In truth, a good grade of copier paper will suffice for most uses, but there is a wide variety of stock (card stock, clear transparen-

cies, parchment, labels, metallic papers) that can be run through your LaserWriter to achieve a distinctive look or to meet a special requirement.

That Special "Laser" Paper

There may be times when you want to achieve a particularly clean image—making a master for photo offset printing, for example. For these occasions, there is a growing variety of special laser printing papers being marketed. Whether you use regular copier paper, a good quality rag bond, or one of the new (and much more costly) laser papers is up to you. LaserWriter masters usually "clean up" when photo offset: that is, the final printed version often looks better than the original laser-printed master. Why? It's really pretty simple. Most of the small imperfections tend to wash out in the photo offset process. Some of these new laser papers offer "wax holdout" for use in pasteup work to keep the wax adhesive from bleeding through. However, before you switch papers permanently, run some side-by-side comparisons. You may want to stay with a good grade of regular photocopier stock.

The darkness of the image can also be important when you reproduce from a LaserWriter printout. The whiter the paper, the greater the contrast with the toner. This can be particularly important if you are using one of the original LaserWriters based on the Canon CX mechanism; it prints an image that is grayer than the images of the new LaserWriters based on the SX engine. In addition, some of these special laser printer papers are specially finished to provide a surface that binds the toner powder better, thus making a darker print.

Heavier Paper

What about heavier weights of paper? You'll probably be able to feed paper up to 60 pounds in weight using the paper tray. Feed heavier stock through the manual feed slot. Collect heavier paper printouts in the face-up tray to avoid jamming the machine. A 70 pound enamel finish stock will yield nice, crisp black images, and small imperfections can be gently scraped away with a razor knife.

With heavy paper the toner ink isn't firmly attached sometimes and can flake away when the paper is bent. To make certain that the toner ink is firmly bonded to the heavier stock, try baking the paper in an oven at 350F for 10 to 20 seconds (longer times may burn the paper). Using a heat lamp is even better.

What about printing on both sides of the sheet? Well, it can be done, but on the original LaserWriters, you're taking chances. Apple has recommended against it on the older machines. During the second pass, the toner already

on the back side gets softened again; you could accumulate toner inside the machine and shorten its life. On the newer LaserWriter II models, use the face-up tray where there is less bending of the paper in its path through the printer.

Labels and Transparencies

There's also the question of printing on self-sticking adhesive label stock. Avoid regular grades of pressure sensitive label stock. They may be designed for photocopiers but won't hold up in the extra heat of a laser printer. The result? A gummed-up jam. Look for special laser printer pressure-sensitive stock that's designed for the higher temperatures. Avery's laser label stock 5160, 5161, and 5162 are acceptable. The firm's Desktop Laser Printer Labels are designed to feed from the LaserWriter's letter-size paper feed cassette. There are other brands as well.

Matte finish adhesive-backed polyester sheets will also work in the LaserWriter. These are handy for producing engineering drawings and the like and are available from ChartPak as Drafting Appliqué Film. With your LaserWriter, you can make all kinds of clear pressure-sensitive labels this way.

Metallic papers can be laser printed if they have a clear tarnish-proof coating to render them nonconductive. Otherwise, toner particles won't adhere.

Clear and tinted transparency sheets can be produced directly from your LaserWriter, or they can be made from a paper laser printout run through your photocopier onto transparency stock. When you make them directly in the LaserWriter, however, remember that laser printers use a higher temperature; make certain that the brand you use is rated for laser printers. A stock like 3M's #503, Groveton's ProTech Laser Transparency film, or Xerox's 3R3108, for example, have been reported to do the job nicely. Avoid 3M's #544, which melts in the LaserWriter, thus resulting in a mess that will cause an expensive service call.

Laser printers, like photocopiers, are designed to best work with standard, letter-sized paper. Envelopes, however, can be printed on your LaserWriter. Simply use the "wide" or "landscape" page setup and manual feed. For the LaserWriter and LaserWriter Plus, feed the envelope so the top side is against the right guide (with the orange arrow). Apply a slight pressure until the envelope has been pulled into the printer. On the newer LaserWriter II models, the manual feed slot works fine, or there is an optional envelope feed cassette that can be used.

A public domain program, Kiwi Envelopes!, will print legal and letter-size envelopes on the LaserWriter without requiring that you leave your current application. Envelopes must be fed manually. Two shareware programs, EasyEnvelopes and Label and Envelope DA, work with both the older Laser-

Writers and the newer center-feed LaserWriter II models. These programs are available through CompuServe or from many local user groups.

There are also two commercial programs for printing envelopes on the LaserWriter: MacEnvelope from Synex and Nvelope for the PC from Paul Mace Software.

Special laser printer envelopes are also coming onto the market. These lie flat and are fed with the standard paper cassette. Groveton's Pro-Tech Laser Envelopes are an example.

When printing any of the special papers or transparency stocks, be certain to use the face-up output tray on the LaserWriter II models to avoid curling and possible jams.

You might want to invest in a second paper cassette for your LaserWriter. Just be sure that you use it for the size of paper it's meant for. If you use a legal-size cassette to load letter-sized paper, you'll get copies printing out wrong. The LaserWriter can tell which tray is which and will assume you have legal-sized paper installed.

Feeding a Hungry LaserWriter

There's no doubt that a heavily used LaserWriter's paper input trays empty out rather frequently. The original LaserWriters held only 100 sheets. The newer ones hold about 200, which is still fairly skimpy.

Large capacity paper feeders are available for the original LaserWriter and LaserWriter Plus (these are the two printers based on the Canon CX engine). The Paper Plus 500 from The Laser Connection will handle 500 sheets or 100 envelopes and comes with a high capacity paper output stacker. You will need extra space at the side of the LaserWriter to accomodate the Paper Plus 500; it sits next to the printer and feeds paper into the manual feed slot.

Sterling Computer's Papermax 500 is another 500-sheet capacity feeder for the original LaserWriters and fits conveniently under the printer.

Ziyad's PaperJet 400/XP sits under the LaserWriter and provides a 350-sheet capacity. It requires about six inches more width because paper is fed upward into the printer's manual feed slot through a riser.

BDT's LaserFeeder adds two 200-sheet bins plus 40 to 60 envelopes to the LaserWriter's 100 sheet internal paper tray. It comes with bin selection control software that easily installs on your Macintosh. BDT's Flipper add-on collates the output face down into a 400-page tray. BDT also has a larger version paper input feeder, the MultiFeeder, which has five 220-page paper input trays and one envelope tray. Additional envelope trays are optional. These feeders stand at the manual feed side of the LaserWriter and take extra room.

Manufacturers are also developing designs for the newer, low profile LaserWriter II models. BDT's compact Model 880 holds 440 sheets of paper

and from 40 to 60 envelopes and can automatically feed envelopes and sheet paper to a LaserWriter NT or NTX.

Your LaserWriter is capable of producing great looking text—text that was simply unrivaled a few years ago. There's no question that the LaserWriter is a "mini-typesetter" capable of producing beautiful results. It makes an image that will really make *your* image, and if you need even better quality, it's easy when you have the PostScript advantage behind you.

CHAPTER **EIGHT**

Getting the Best Graphics Out of Your LaserWriter

Graphics—Objects Are Better Than Bits

A Deeper Look at Graphics

A Halftone Is Better Than No Tone At All

Scanning to the Max

Improving on "Nature"

If laser printers printed only text, they'd still be pretty popular, but they do it all—text *and* graphics—and in a remarkable quality. If they didn't, you wouldn't have desktop publishing, one of today's hottest new uses for computers.

Basically, there are three kinds of laser printers. The ones selling for $1,500 to $2,500 are really upscale replacements for daisy wheel printers. They churn out very handsome correspondence, and most can even add a small area of high quality graphics. If you want more graphics and the ability to download bit-mapped fonts, you can buy a more expensive one that has more memory for an additional thousand dollars or so. However, if you really want total control over things, and if you want to use your printer as a low cost typesetting and pagesetting output device, then you're in the four to six thousand dollar range with a laser printer that has at least two megabytes of memory and a page description language. These high-tech marvels combine text and graphics in any ratio you wish—they do it all.

That's just what you have with Apple's LaserWriters. They're the PostScript-controlled printers that do it all (especially graphics) superbly.

There are many ways to handle graphics on a LaserWriter, and some ways yield higher quality than others. Since these printers are quality oriented, we need to look at the various kinds of graphics and how the LaserWriter works with each kind. This will help you get the finest work from your marvelous LaserWriter.

Graphics—Objects Are Better than Bits

If you wanted to describe a line around the earth, you could grab a paintbrush and begin marking it as you went, or you could simply state where a line of a certain width would fall. Both procedures would do the job but in very different ways. Similarly, in the world of computer graphics, there are two basic ways to make pictures come to life on your screen or printer. The most common method is one that we've already talked about—bit-mapped graphics.

Bit-mapped—One Dot at a Time

All the graphics you see on your Mac's or PC's screen are bit-mapped. This means that what you see is actually made up of thousands of dots. On the Macintosh screen, for example, there are 72 dots, or *pixels* (short for "picture elements"), along each inch.

You're working with bit-mapped graphics every time you print something on the ImageWriter or any other dot matrix printer. The printer's printhead

contains tiny wires that fire on command from the computer to strike the ribbon and make their marked image on the paper below.

One central characteristic of bit-mapped graphics is that you must define the exact location of each bit or pixel. There's no room for error, and every dot must be described accurately in order to be displayed or printed, which requires memory to hold all the information needed to define every bit's position.

That's why your LaserWriter has so much built-in RAM memory. There's enough for a complete page full of bit-mapped graphics. Many other printers restrict you to just a few square inches of graphics because they just don't have the memory. Avoid them for all but routine correspondence printing. They're woefully inadequate for complex tasks like desktop publishing and design.

If you wanted to describe a straight line, you could tell the computer and printer to place dots at each position that falls on the line and instruct them not to print all the rest. Your page would be mostly *no's* that indicate where not to print or show a dot. A handful of *yes's* would be mixed in. Doing this would display or print your line in bit-mapped form.

Objects—Making Life Easier

There's another way, however. If you told the computer to connect point A with point B and described the line width, all you would need are those three pieces of information. This beats having to describe each single dot on the page. This is possible in the world of computers, and it's called "object-oriented" or "vector" graphics. Everything on the screen is described in the form of objects—lines, circles, ovals, squares—that have been built into the software or hardware (Figure 8.1).

In essence, you're having your computer use plane geometry to describe the drawing on the screen. Something subtle does happen behind the scenes, however. Once inside the LaserWriter, these object-oriented descriptions are converted into bit-mapped form so that they may be "painted" back and forth by the printer's laser beam.

Figure 8.1. Circles: Bit-mapped versus object-oriented graphics. Use the latter for higher quality.

Perhaps this reminds you of your television set. It works in much the same way, converting a transmitted frequency signal into a back and forth sweep across the picture tube to form the picture's image. The electron gun in your TV's picture tube and the laser and optical system in your LaserWriter are both examples of "raster scan" devices that "paint" an image back and forth.

In the computer, you can use Claris's MacDraw or Innovative Data Design's MacDraft, for example, to create object-oriented files. In the laser printer, these files are converted into a bit-mapped raster scan. This makes it sound like they come out looking just about the same as a bit-mapped graphic printed from Claris's MacPaint. They don't. Object-oriented graphics have a finer resolution because they are converted into bit-maps once they're inside the laser printer. This means that their resolution is at least 300 dots per inch. The newer and greatly improved version of MacDraw, MacDraw II, allows editing the figure at 2,000 dots per inch, which is good enough for Linotronic typesetting.

One object-oriented drawing program, MiniDraw from Software for Recognition Technologies, is in a desk accessory form. MiniDraw can therefore easily add graphics to any of your other programs, which is especially useful with word processors and the like.

Normal bit-mapped graphics from programs like Claris's MacPaint, FullPaint, or Z-Soft's PC Paint are created in the computer where the resolution is much lower and coarser—72 dots per inch. And that's the way they stay, even when printed out on your LaserWriter. Yes, they do look better than when printed from an ImageWriter, but they still fall short of the crispness and clarity that the LaserWriter is capable of producing.

One improvement over the original paint programs is the availability of 300 dot per inch painting software like Zedcor's DeskPaint or Cricket's Cricket Paint, but they don't improve when typeset at higher resolution. They'll still be at 300 dots per inch. In all, the best graphics come from programs that treat everything as objects and mathematical shapes. With these, you'll be getting seventeen times better resolution and print quality when you use object-oriented graphics than when you use the MacPaint-style bit-mapped variety.

On the MS-DOS side of things, you will find a variety of different file formats for bit-mapped graphics which limits the compatibility between programs. A conversion utility, The Graphics Link from PC Quik-Art, will help you convert among ten of the most popular MS-DOS graphic formats.

Heavyweight Bits

Would you like another reason to use object-oriented rather than bit-mapped graphics? We've talked about the amount of data needed to describe bit-mapped versus object-oriented graphics. Table 8.1 shows how much the dif-

Table 8.1 Comparative Data Requirements for Bit-mapped and Object-oriented Graphics

Software	*Type*	File Size (bytes)
MacPaint	*bit-mapped*	3,100
FullPaint	*bit-mapped*	2,560
Super-Paint	*bit-mapped*	2,600
MacDraw	*object-oriented*	545
SuperPaint	*object-oriented*	1,960
CricketDraw	*object-oriented*	690

ference really is for a simple one-inch circle drawn in a medium weight line width.

As mentioned before, sending all the graphics information to the LaserWriter and then processing it into the page's image takes time, and if you print bit-mapped graphics out in a landscape or sideways orientation, you will sit quite a while waiting for the printed sheet to emerge. The LaserWriter must mathematically translate the position of every dot, which is a slow process. Consequently, the first step in getting the best graphics out of the LaserWriter is remembering the difference between bit-mapped graphics and object-oriented graphics.

A Deeper Look at Graphics

Just knowing the difference between bit-mapped programs such as MacPaint, FullPaint, and PC Paintbrush, and those that are object-oriented such as Claris's MacDraw, Mac3D by Challenger Software, or VP-Graphics, a PC drawing program from Paperback Software, will help you choose the best tool for creating high quality graphic images from your LaserWriter. Remember that any text you place in a bit-mapped paint program will be printed out as a bit-mapped image. It's better to place your bit-mapped drawing into MacDraw and use MacDraw to create the text portion.

Even better are combination programs like Silicon Beach's SuperPaint, Mindscape's GraphicsWorks 1.1 or CANVAS by Deneba Software for the Macintosh and Z-Soft's Publisher's Paintbrush for the IBM with both bit-mapped and object-oriented modes. Use the latter mode to create the needed text and regular objects—circles, rectangles, lines, and so on. Restrict the use of the paint mode to only those techniques that aren't possible with the draw function. These four programs also have a 300 dot per inch bit-map painting mode which matches the LaserWriter's high resolution and is useful for cleaning up rough edges.

Three-dimensional drawings can be produced with most object-oriented programs, but the process is facilitated with Gridmaker from Folkstone Design which allows you to create three-dimensional grids that act as guidelines to help give accurate perspective to your drawings.

High Quality Clip Art Comes in Handy

If you're like a lot of LaserWriter users, you'll be adding art to your text. The LaserWriter does a beautiful job of reproducing graphic art, especially the object-oriented kind.

Clip art programs are convenient, especially if you're not an accomplished artist. However, if you plan on using a clip art program containing predrawn art files, look first for those clip art collections that are in PICT, MacDraw, or encapsulated PostScript (EPS) format. ArtWare (LaserGraphics Corp.), Click & Clip (Studio Advertising Art), Kwikee Inhouse (Multi-Ad Services Inc.), Olduvai Clipart (Olduvai Software), Draw Art (Desktop Graphics), ClipArt (Compuset), Digit-Art Laser Graphics (Image Club), Electronic Clipart Digest (SSG Laserworks), Desktop Art (Dynamic Graphics) and IMAGESWITHIMPACT (3G Graphics) are available for the Macintosh. Windows Portfolio, Clip Art Libraries (Micrografx) and PC Quik-Art (from the firm PC Quik-Art) are examples of MS-DOS clip art. These object-oriented graphics are of the highest quality and will scale to any size without losing their quality, which will be maintained if the file is sent to a phototypesetter, too.

Now that highly accurate drawing programs such as Adobe Illustrator and Aldus's FreeHand are available, you will see clip art collections prepared in the extremely fine detail that is capable of being produced from this software when it is used by graphic artists and designers. In fact, Adobe has its own clip art package, Adobe Illustrator Collector's Edition, with lots and lots of predesigned basic graphic shapes, including 100 border designs and over 300 dingbats—those little graphic "whatnots" that can spice up a publication. T/Maker has a line of clip art packages for the Macintosh and IBM-PC created with Adobe Illustrator. Because the file format is in Encapsulated PostScript (EPS), not every kind of software will be able to import the images. Most page layout programs, however, will accept EPS graphics. T/Maker also has Scrapbook+ to allow IBM-PC users to store and view EPS format graphics files in addition to SYLK, standard bit-mapped graphics, and ASCII and Windows Write text files. Artware Systems and 3G Graphics also offer PostScript clip art collections.

PS Collage, a structured PostScript drawing program for the IBM-PC and the Macintosh, is available from PS Publishing and supports layered drawings to facilitate color separations.

Most common, however, are the clip art disks made up of bit-mapped or MacPaint graphics. If you can't find exactly what you want in an object-

oriented collection, then try a bit-mapped one. Most are lower quality, however, and will look a bit choppy and rough. There are a few tricks that will improve them. We'll talk about these shortly.

There are some bit-mapped clip art collections that are available in a 300 dot per inch resolution. These images have been scanned and retouched to give a very high quality. They won't, however, improve when imaged through a Linotronic, nor can they be scaled to different sizes without distortion. The MacGraphics Collection, however, is a bit-mapped collection of drawings that will print at 300 dots per inch from the LaserWriter and 2,450 dots per inch from the Linotronic 300 typesetter. This 9-megabyte collection from GoldMind Publishing is available in Macintosh and MS-DOS format. Another 300-dots per inch clip art collection is available from Metro Image-Base.

Keeping Track of Your Clip Art Collection

How can you keep track of all these clip art offerings and know who supplies what? The *MacTimes Clip Art Directory and Guide* will be a big help. It's a book and HyperCard stack that contains product reviews and a complete visual index to various clip art collections. With the HyperCard stack, you can use key words to search for specific images. You'll still have to purchase the clip art collections that you want to use, but this will help you locate the images that you're looking for. There are also updated volumes to keep up with the flood of published clip art.

A handy desk accessory for graphics work, Artisto+, is available from user groups such as the Boston Computer Society. It will open MacPaint and PICT files and allow you to copy any portion of the image to the Clipboard. From there you can paste directly into your application, which is a nice way to include graphics in your documents without ever leaving your application program.

Keeping track of a large collection of graphics can be a real problem. Don't worry though, because for almost every problem, there's a software package designed to solve it. Graphidex, a desk accessory graphics management program from Brainpower, will define and index up to 500 pictures in MacPaint or MacDraw format to allow you to search for, preview, modify, rotate, scale, and paste images into your application.

There's also The Curator from Solutions Inc. It comes as both a desk accessory and an application, and will index your graphics files in a pictorial table of contents. It handles PICT files, Encapsulated PostScript and scanned TIFF files, and will allow cropping prior to pasting into your application. Graphics created in 72 dot per inch bit-mapped graphics programs (MacPaint, FullPaint, etc.) will be improved when pasted from The Curator into most other programs.

Shrunken Bits Are Better

SuperPaint graphics can be improved by drawing the bit-mapped image layer at a larger size than needed, and then copying it into the draw layer and scaling it downward. Paint layer images are printed at 72 dots per inch, while draw layer images are printed at 300 dots per inch. Thus, images from the paint layer can be scaled to 25% of their original size without a loss of pixels. Simply select the paint layer and choose Copy to Drawing Layer from the Edit menu. Then delete the old paint layer after the transfer is made.

Solutions Inc. also has improved the Mac's Scrapbook with its SmartScrap. This scrapbook allows you to create a pictorial table of contents, and it can open any scrapbook file on any disk without having to rename it or move it. In addition, you will be able to rename your scrapbooks with any names you want. It comes with another desk accessory program called The Clipper, which allows precise scaling of graphic images so you can reduce, enlarge, or crop the image prior to placing it into your application.

If you must use the bit-mapped variety of graphics, try bringing in the graphic in the largest size possible and then shrinking it down when placed in your document. For example, you can bring MacPaint images into MacWrite, MacDraw, or Microsoft Word and shrink its size by moving the corner handles inward. The screen image will look dark and indistinct, but the laser printout should retain most of the original detail. Scaling to 96 or 48 percent of the original will give the best results. Use the rulers to check the degree of reduction.

Even better, The Clipper from Solutions Inc. and Graphidex from Brainpower, both described above, will allow you to accurately scale bit-mapped images to an even multiple of the LaserWriter's 300 dot per inch resolution.

DeskPaint, a very full-featured, bit-mapped graphics program in desk accessory format (it takes less than 30K) from Zedcor can also be used to accurately scale bit-mapped images for improving the printed LaserWriter output. It also allows you to browse through bit-mapped image files to create a slide show effect or to open images for placement into other applications.

When printing documents already containing bit-mapped graphics, printing the laser copy at 96 percent of the original size will improve the image, although the typesizes and the margins will be correspondingly smaller. To avoid scaling the text, simply scale the image to 96 percent, using the rulers for estimation, or scale the image in one of the programs mentioned above before placing it in your word processing or page layout program. A FatBits, or magnification mode, will help if there's one available in the software you're using. DeskPaint has specific LaserWriter scaling routines that are especially easy to use.

In case you're wondering why this works, bit-mapped graphics appear on the Mac screen at 72 dots per inch, which is not an even-numbered multiple of the LaserWriter's 300 dot per inch capability. The newer LaserWriter

print menus (Version 4.0 and higher) make the job easier by allowing the selection of this proportional scaling directly from the LaserWriter Options print menu by choosing Precision Bitmap Alignment (4 percent reduction).

Scaling to 96 percent will bring the image to 75 dots per inch, an exact multiple of the LaserWriter's resolution. Some graphics software does this automatically when you choose the LaserWriter.

Bit-mapped images often don't look much better issuing from a LaserWriter than from the ImageWriter II. That's because 72 dots per inch is still 72 dots per inch, no matter which printer you print it on. Yet, there is a built-in smoothing routine you can use to help take out the "jaggies" from your graphics. Just look for it as an option on your LaserWriter Page Setup menu.

If, perhaps, you're in a program that has its own LaserWriter Page Setup and Print menus (Microsoft Word, for example), and it doesn't include any of the optional "extras" that are available in Apple's menus, you can access the System's standard dialog boxes by pressing the Shift key while you choose Page Setup or Print from the File menu.

Avoid printing bit-mapped graphics that you have rotated in MacDraw in the landscape or sideways mode. You may get white lines across the printout. It is better to rotate the image using T/Maker's Click-Art Effects or from within Ann Arbor's FullPaint or Silicon Beach's SuperPaint.

PostScript Does It Best

If art is your profession, there are few tools better than the direct PostScript drawing programs designed specifically for the LaserWriter and Linotronic imagesetters. You get smooth control over curves that are simply impossible from QuickDraw-to-PostScript tools like Claris's MacDraw. PostScript is a richer graphics language and thus carries many more possibilities with software specifically designed for it.

The high-powered PostScript drawing programs like Adobe's Illustrator, Cricket's Cricket Draw and Aldus's FreeHand are not intended for the casual user. They are artist's tools designed for the graphic arts. We'll provide more about them in the next chapter. If you are using Illustrator, however, you should look into Xris-Xros from Taylored Graphics. It takes any PICT file drawing and converts it to Illustrator format so it can be enhanced with the Illustrator tools. If bit-mapped graphics are also contained in the input file, they will be removed in the final converted format.

A Halftone Is Better Than No Tone At All

There are an ever increasing number of digitizing scanners becoming available thanks to the popularity of desktop publishing. These units take printed hardcopy and convert it into computer-compatible bits so you can place it into documents or edit the image to add special effects. There are four main

kinds of graphic scanners. Some, like the ThunderScan, are run by your dot matrix printer. Its scanner head replaces the printhead. Others are flatbed or sheetfed scanners that work like photocopiers. Still others focus on the work, including video camera models. Before we look at how to improve the images we get from scanner input, let's first consider the two main kinds of images that can be scanned.

Two Kinds of Art

First, there's simple line art. Here the artwork consists of black and white lines and shapes. It is simply line drawing rendered in *only* black or white—no grays. Second is continuous tone artwork—the tones smoothly range between black and white with grays blending and changing. A photograph is perhaps the most familiar example of continuous tone artwork. Very little area of most continuous tone images will be 100 percent black or 100 percent white.

Line art is relatively simple to scan. Each tiny area is viewed by the scanner, and the information is stored as either black or white. Each scanned pixel requires a single bit of computer information for storage. It's either on or off, black or white. Of course, the higher the resolution and thus the smaller the viewing area of each bit, the better the image and the larger the data file. At 300 dots per inch, an 8 by 10 inch scan will take about 900K.

Scanners do a very nice job digitizing simple black and white line art, but the original must be carefully lined-up if the scanned image is to be faithful. Otherwise, horizontal and vertical lines will come out jagged and stair-stepped. A flatbed scanner is the easiest to align.

You may already be wondering how a scanner can handle continuous tone artwork if it can record the image only as bits of pure black and pure white. In other words, how can it work if it takes all the grays and makes them into either black or white? In fact, adding to the problem of input is the output problem. Laser printers print their images in the form of tiny dots, and they're in either black or white—no grays. Indeed, high quality imagesetters like the Allied Linotronic and the offset printing process are black-white in nature, too. None of these devices or processes can produce true grays.

Faking It by Combining Dots

Don't give up yet, though. There's the halftone to the rescue. You've probably heard the term before, but in case you don't know what it means, read on.

The eye is a great trickster. Look at TV or a movie, and you see lots of action. But, as we know, they are just a lot of still images being aimed at us very quickly in succession, which creates the illusion of motion. Well, halftones are trickery, too. If we take that beautiful photograph made up of its continuously ranging shades of gray and somehow magically change those grays to areas of variously sized black dots, our eye will be tricked into seeing a continuously-variable gray scaled image.

Look at a picture in today's newspaper. If you use a magnifying glass, you'll see that the image is made up of dots. Yet the dots aren't all the same. In the darker areas, the dots are larger, and lighter sections contain smaller size dots. Even though there are different size dots depending on the darkness or optical density of each area of the image, the *number* of dots is the same. You can see this in Figure 8.2, an illustration of the Macintosh screen.

This is an important point. The degree of grayness for a certain area doesn't depend on the number of dots but on their *size*. The number of dots is an important factor, but it doesn't set the gray levels.

The screen frequency, or number of dots or lines per inch, determines the quality of the halftone image. The higher the screen resolution, the better the image. Newspapers, for example, use halftone screens of about 70 to 90 dots per inch. With the coarse newsprint paper stock, a greater number of dots per inch would simply smudge the image together and lower the overall quality. Magazines use a higher screen resolution, up to 150 dots or lines per inch.

In short, black and white can simulate grays by using halftones, that is, certain numbers of variously sized dots.

Computerizing Halftones

We're not quite finished yet, however, with our halftone story. There's more, and it's worth knowing about if you're going to use scanners. Here goes.

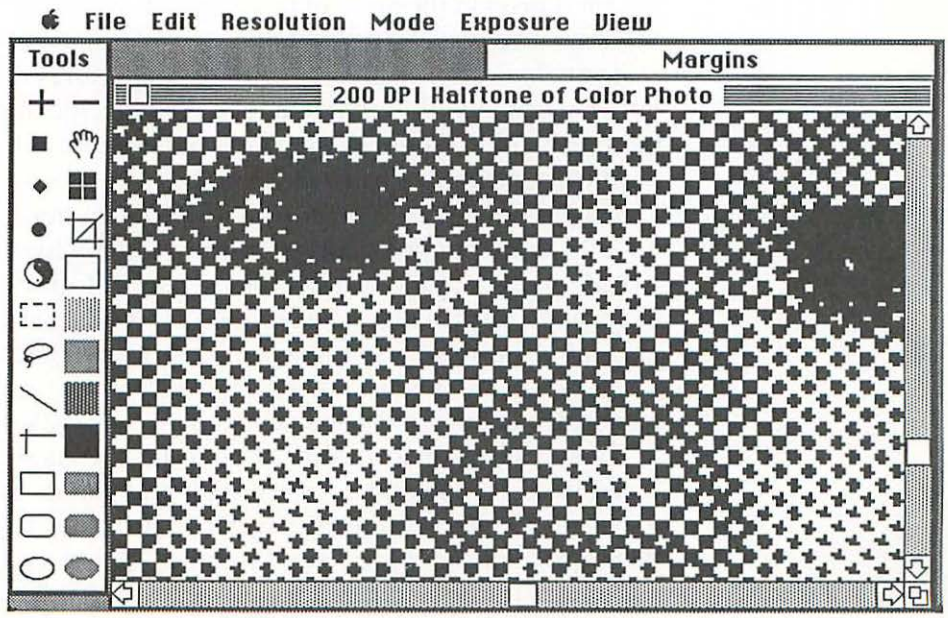


Figure 8.2. Screen image: Note that the grayness of the computer halftone image is created from larger and smaller groupings of black pixels.

Now that we understand halftones, we've got to get them into the computer and in a form that our LaserWriter and its PostScript cousin, the Linotronic, can work with and understand. We're going from halftones to digital halftones.

First, the scanner must be able to read the image pixels as black and white or, preferably, as gray scales, and its software must then convert the information to halftones.

This sounds simple so far, but if you thought you'd be turning out photographic quality copies from your LaserWriter, you're going to be disappointed. The nature of digitizing halftones requires that a Linotronic or other PostScript imagesetter be used for high quality halftoning. The LaserWriter just isn't good enough to give really good, magazine-quality halftone images. Before too much disappointment sets in, here's the reason.

Remember that a laser printer or imagesetter deals only with dots that are either black or white, and each dot is the same size. Scanning at 300 dots per inch will certainly give you a good quality black and white pixel map of an image, but the image is black and white with no grays; it will be high contrast.

In order to get a halftone dot having a gray scale attached to it, the scanner must originally assign a gray value, or several black and white scanner pixels must be grouped together and averaged. For example, if you took each 4 by 4 array of pixels to make the corresponding halftone dot, you could show any level of gray between white and black by progressively blackening each pixel in the array until you got to 16 pixels of black. If 8 pixels are black, you've got a 50 percent gray.

If you think about it then, with a 4 by 4 pixel array making up each halftone dot, you can record 17 different levels of gray, including black and white. In the true world of publishing, that's not enough different levels of gray to produce a clean, sharp image.

If we go to a 5 by 5 pixel array to produce our halftone image, we can have 26 levels of gray—not too bad but still not high quality (Figure 8.3).

Let's go back to the scanner for a second. Most will produce 300 dots per inch, which is quite nice when printed as bit-mapped images. Yet, we're talking halftones, aren't we? Using a 4 by 4 pixel to halftone dot ratio, that 300 dots per inch is going to make 75 halftone dots in each inch, which corresponds roughly to newspaper standards but with only 17 levels of gray.

If you really wanted to paint a true-to-life oil painting using shades of gray, you'd have as many tubes of different gray paints as you could. The more the better. Remember, the rules won't let you blend the paints, but only apply them straight from the tube to the canvas, dot by dot.

Perhaps now you're beginning to see why 300 dot per inch bit-map scans don't halftone very well. There are just not enough dots to form enough

3 x 3 cell	4 x 4 cell	5 x 5 cell
10 gray levels	17 gray levels	26 gray levels

Figure 8.3. Halftone cells: The size of the array determines the number of shades of gray that are possible.

halftone cells that have enough gray scale information to them. That's what happens when you try to take black and white scan information and make it into halftone grays.

There's another slight difference in the way halftones are made traditionally as opposed to using a computer. Newspaper halftones are made up of circular dots of varying diameter. Look back at the Mac screen halftone image (Figure 8.2). It's made up of square, "blocky" dots that are called "dithered halftones." As a result of their differences, you'll just never get the two to be absolutely equivalent.

Going "Gray"

All this sounds like a dead end, but it's not quite as bad as all that because some scanners and their software are intelligent enough to read the actual gray scale information for *each* pixel. This makes a difference. In addition, gray scale images aren't fixed as bit-mapped images. They can be recalculated for the best appearance for a given resolution without distortion.

You see, we've been talking about scanners that take bit-map information and then attempt to create a gray scale halftone from it. You can edit these files with a paint program, but they won't ever look really great, and you can't change the brightness or contrast of the image. It's set.

Scanner and scanner software technology is changing fast, however, and units that save the gray scale information are now becoming readily available. They range from the modestly priced ThunderScan to the more expensive video digitizers such as the Micron Eye from Micron Technology or New Image Technology's Magic video camera, and LaserMagic software and the Imagizer from Comtrex. There are also gray scale scanners like Microtek's MSF-300G, Dest's PC SCan 2000 and the pricey but feature-packed AT&T Targa System for the PC or its NuVista for the Mac II.

These systems read and store the gray scale information with each pixel bit, and with this data you can change and enhance the image considerably. Using the right software (CyberResearch's CyberMerge with the Targa

System, Knowledge Engineering's LaserTools with ThunderScan or MacVision images, Abaton's C-Scan with the Abaton scanners, and New Image's LaserMagic software with its Magic and LaserMagic digitizers, Letraset's Image Studio, or Silicon Beach's Digital Darkroom), you can change the halftone cell configuration, the contrast, and the brightness, and you can change the size of the images and produce PostScript files that can be used to generate high quality halftones from a Linotronic imagesetter. Your Mac or PC screen image won't be anything to celebrate, but the Linotronic output will be very good. Yes, even from a lowly ThunderScan. All it takes is time and patience.

For example, Image Studio brings in TIFF, Thunderscan, and MacPaint files and allows their editing with a wide variety of tools, including up to 64 gray levels. Filters, edge tracing, graymapping, screening, and user-changeable fill patterns can be used. Final work can be saved as TIFF, RIFF (a compressed raster image file used for storing gray scale files which is similar to TIFF), EPSF, and MacPaint files.

Scanners and, in some cases, scanner software which create gray scale information are becoming the norm. This means that the tiny dots or pixels are no longer scanned or stored as being either black or white; they are saved as specific shades of gray, thus making a much higher quality image. Some permit only one or two bits of gray scale information per pixel; others save eight bits of gray level per pixel, creating images having 256 levels of gray. Using the latter kind will achieve the highest quality output from a Linotronic.

Gray scale scanned images have several advantages. For example, you can enlarge a gray scale TIFF image without affecting its final printed quality. This can, however, take lots of memory—an 8 by 10-inch image with 256 levels of gray is about 8 megabytes and takes quite a lot of time printing from a Linotronic. Thus, memory and storage are rapidly consumed when gray scale graphics are included.

Gray scale images are really best printed on a Linotronic 300 at 2,450 lines per inch. Using your LaserWriter will get you into the low end of newpaper quality halftones. If this is good enough, fine. Otherwise, a LaserWriter is useful only for proofing purposes.

Scanning to the Max

There's a lot to getting the best scanned image for your money, so it's best to keep several salient points in mind when looking at scanning and digitizing equipment.

Inexpensive scanners, like Thunderware's Thunderscan, can produce very nice graphic input if you are prepared to work and wait a bit. For instance, scanning at 400 percent (a slow process) for printing at 25 percent generates very good quality. In addition, Thunderscan will save 32 gray

scales per pixel. Scanning at these higher resolutions creates larger files, however. There's lots more information, and you'll be using up more disk space and taking longer to scan and to print, but the image will be much improved.

Other more expensive scanners use a 300 dot per inch resolution that matches today's laser printers. If you thought that 72 dot per inch MacPaint images take up lots of disk storage space, these 300 dots per inch files are mammoth. An 8 by 10-inch bit-map at 300 dots per inch takes about 900K of storage and usually necessitates using a hard disk for storage. Then, of course, the data has to be transmitted to the LaserWriter for printing. Prepare for a short wait. Some scanner software has a file compression scheme for TIFF and other formats, which can help reduce file size.

Consider how the originals are handled, too. Most scanners are either roller-fed or flatbed. The latter is more versatile and handles input from books, magazines, paste-up boards, and even irregular flat objects.

Reading Words, Too

Look for the ability to scan in both line art and halftones. A few models such as Dest's Scan Plus, Datacopy's Jet Reader, and New Image's MacScan have software available that scans text and converts it into ASCII text characters for inclusion into a word processing document. This optical character reader (OCR) capability could be important if you have lots of typed or printed documents to rekey into your system.

If you already have a scanner or if you buy one that doesn't have OCR capability, Read-It! from Olduvai Software will add text-reading capability for only a few hundred dollars. It works with any scanner, including the inexpensive Thunderscan, and has a "learning mode" so that it can learn to read new typefaces.

Going "Video"

We have already briefly mentioned digitizing cameras. These units generally use a video camera for input, but many can also read in image signals from televisions, videodisks, and VCRs. There are fewer image editing and manipulation software packages available, however, and the resulting files may not save images in a file format usable by your page layout software. The Imagizer from Comtrex, however, will save PostScript files containing up to 256 levels of gray and comes with a 850-line high-resolution video camera.

There is also QuickCapture from Data Translation, a plug-in board and software for the Mac II that captures 640 by 480 pixel images from a standard video camera or VCR at rates up to 30 frames per second. The image can then be edited with up to 256 gray levels and saved as TIFF, PICT, or PostScript format.

File Format Is Important

Scanner software varies from brand to brand in its ability to save the scanned image in a variety of formats. Look for the ability to save in TIFF (tagged image format), PICT, EPSF (Encapsulated PostScript), MacPaint, SuperPaint, and PageMaker formats. Many of these come with software to generate PostScript files which can be edited and enhanced. If your scanner doesn't have this ability, Knowledge Engineering's LaserTools can be used to convert MacPaint and other bit-mapped files into PostScript.

A public domain program, SuperConvert, will convert bit-mapped paint files among SuperPaint's LaserBits format, EPSF, TIFF, and ThunderScan formats. Check with a local user group for it.

All is not lost, however, if your scanner doesn't support printing on a PostScript device like the LaserWriter. Save the file in TIFF format and import it into a program such as PageMaker that reads TIFF files and has a LaserWriter driver.

Trouble begins when you attempt to scan art and save the image as a bit-mapped file, especially when it is composed of halftones like a printed magazine picture or continuous tones like a photograph. To do proper justice to halftone and continuous tone input, you'll need a scanner or digitizer that will read the gray scale information from the input and save it in the image file without first converting it to a bit-map. Many are coming onto the market.

Remember, too, that if you attempt to scan a printed halftone from a magazine, your scanner's attempt to re-halftone it will create a very undesirable pattern, which is called a "moiré pattern," superimposed on the scan.

You'll also need the software required to manipulate gray scale information as described above. Once you've done all that, the best quality comes from printing it on a Linotronic rather than on your LaserWriter. Don't think that it'll print out quickly, though. That much data takes a long time for the imagesetter to process. It could even be an hour or so.

Although halftoning a digitized image gets you the best ultimate image, using a 300 dots per inch bit-mapped scan is certainly good enough for newsletters, flyers, etc. If your scanner will also save gray scale information, then the digitized image can be manipulated in many interesting ways. For example, the density or number of halftone dots per inch of the screen can be changed, and areas lighter or darker than a set level of gray can be converted to white or black to create special effects.

If the file is then converted to PostScript, other effects can be made by adding to or modifying the PostScript code.

Getting into a "TIFF"

Remember that scanned graphics are not always WYSIWYG. Often the image looks better coming from the printer than it does on your monitor's screen. Some effects just can't be faithfully represented on the screen because pixels

or screen dots are either black or white. TIFF files, though, can handle actual shades of gray instead of just black and white dots that try to represent grays. Although your screen image won't be as high quality, using the TIFF format generally results in the best image for scanned art and gives a more photographic look to the image printed on the LaserWriter.

Many scanners give you a choice between TIFF file formats: dithered or gray scale. Gray scale images usually print better and faster than their dithered counterparts and can be resized without creating a mottled or streaked image. Gray scale TIFF images are bit-mapped images that have gray scale values for each dot, and most page layout programs are able to import and manipulate these images.

Encapsulated PostScript (EPS) files are also very high quality image files. They usually consist of the PostScript code for the image, along with beginning header that helps it to be accepted into full PostScript files. Along with the EPS file that prints the image from the LaserWriter, there is usually a bit-mapped TIFF file that forms a high quality screen image on the monitor. Even without the TIFF file, EPS files can be used in many page layout and other programs. You simply won't see the actual image on the screen; you'll see only a box representing the image.

It's also possible to capture images from video cameras, video laser disks, and video cassette recorders. Use Aldus's SnapShot software for the PC along with either one of several compatible frame grabber boards such as Data Translation's QuickCapture or with a video digitizer such as Koala's MacVision or Pixelogic's Pro-Viz for the Macintosh. SnapShot, for example, takes images from any video source and creates a bit-mapped or TIFF file in 512 by 512 resolution with up to 256 gray levels. Images can be edited with Aldus's image enhancement software.

Getting high quality scanned images takes patience and practice because much of the process is really an art, but there are several steps you can take to assure that the printed images will be as close as possible to the original. First, use as good an original as you can. Fuzzy prints, out-of-focus photos, and poor contrast all limit the quality of the final scanned image. Photos with a wide range of gray tones usually scan the best into halftones. If the artwork is line art—that is, a line drawing—scan using two levels, black and white.

Second, if you are scanning in black and white, scan at a low resolution and reduce the image size once it is placed in your page layout. Use the software's precise scaling to match the printer resolution, if this feature is available. If you want to keep the same size as the original image, scan at the same resolution as that of the final output printer. For your LaserWriter, scan at 300 dots per inch. If you are using gray scale TIFF format, scan at a resolution lower than the resolution of your final printed output. For the LaserWriter, scan at 75 dots per inch. Then you can resize with little or no loss in the quality of the final printed image. If, however, you want to enlarge the image in your

publication, scan at a higher resolution, such as 150 dots per inch. If you are using the Linotronic for output, you should also try scanning at 150 dots per inch.

Third, set the brightness and contrast controls to achieve the effect you want, remembering that a change in brightness changes every dot in the image, thus making it lighter or darker. Contrast, on the other hand, changes the number of gray levels. Increasing the contrast lowers the number of gray levels, resulting is a more starkly black and white image.

Finally, use a good scanned image editor, a program that lets you change and touch up the image. We'll discuss some of these programs in the following section.

Is it all worthwhile? Well, many people say it is, and many people say it isn't. A camera-produced screened halftone is often less expensive and of higher quality than a scanned digital gray-scale halftone. Yes, it does involve the old way of doing things, and you do have to paste the halftone onto your layout physically, but that's really a small drawback. Going completely electronic with both text and graphics is becoming feasible. Whether it is entirely practical, especially for halftones, is really up to you to decide.

Improving on "Nature"

You don't necessarily have to be satisfied with the quality of the graphic image that you want to print from your LaserWriter. There are ways to improve the image. Some procedures require very special techniques, but others are well within anyone's capability.

Touching Up Your Paintings

If you first transfer MacPaint or Ann Arbor FullPaint files into a program that allows smoothing, such as MacWrite or Microsoft Word, you will be able to produce cleaner, less jagged printed images. Remember that using the smoothing feature increases printing time so you may not want to have the smoothing option on for each printing during the editing process.

These programs also allow a reduction of the image for printing. For best results, select a 25 or 50 percent reduction. The results will be very sharp. Other percentages may cause some distortion and degradation of the printed image. Some programs will allow the correct reduction to be made automatically. In PageMaker, for example, holding down the Shift key during scaling restricts the reduction to the correct increments in order to match the LaserWriter's resolution.

DeskPaint from Zedcor allows editing of TIFF files at resolutions from 300 dots per inch all the way to 4,000 dots per inch and can edit MacPaint files at any magnification. Graphics files may be lightened or darkened to adjust the brightness or to control the shading, and text can be added to any image.

Precise scaling from an eight times magnification to a one-eighth reduction can be done automatically to match the LaserWriter's dot resolution so that quality can be maintained. In other words, enlarging an image eight times will actually increase the size 768% which will precisely match the 300 dot per inch resolution of the LaserWriter, which is quite handy if you're bringing bit-mapped graphics into page layouts. DeskPaint will help them retain their quality.

If you're using your LaserWriter for a lot of graphics work, DeskPaint can be a boon. It has a "browse mode" to look through any bit-mapped graphics file (MacPaint or TIFF) on your disk and can open them up for editing.

Converting graphics files into PostScript also gives you a wide range of control. MacPaint files or scanned graphics from MacVision or Thunderscan can be directly converted into PostScript using LaserTools from Knowledge Engineering. This will improve the image and allow printing on PostScript typesetters.

Editing Those Scans

If you've been using ThunderScan for a while, you might check the features of your scanning software. In mid-1987, ThunderWare released new software that improves the scanning image and creates PostScript files which may be printed on the LaserWriter or Allied Linotronic PostScript imagesetters. The new software assigns four bits per pixel to allow more gradients of gray. You can also include PostScript files created externally for special effects.

Getting the best graphics from scanners can be done by editing and cleaning up scanner images. A program such as Letraset's ImageStudio can be used to touch up scanned photos and other images. Files from ThunderScan, MacVision, Abaton, and Microtek scanners may be retouched in up to 65 shades of gray. Contrast and brightness may be controlled, and a wide variety of editing tools are provided. Final files may be output to the LaserWriter or saved as PostScript documents. For PC scan files, ZSoft's newest versions of PC Paintbrush+ and Publisher's Paintbrush will accept gray scale information from a variety of scanners to allow editing.

Some page layout programs, such as Quark's Xpress and PageMaker 3, will allow the changing of gray scales much like the equalizers do on stereo equipment. You can change selected gray levels and turn them into a different gray setting. For example, 10 and 15 percent grays could be changed into 25 percent gray, and 90 percent gray could be changed to 80 percent. Gray levels are thus "tuneable" to suit any special need you might have. This feature may also find its way into future versions of scanner software.

Silicon Beach's Digital Darkroom is another gray scale manipulation program which converts gray scale, bit-mapped images into objects that can be saved in a number of formats, including PICT and Adobe Illustrator file types. Also included is the capability to add filters and special effects to the

image. The software allows you automatically to trace bit-mapped images, including scanner files, to create vector outlines that can be imported into Adobe's Illustrator for manipulation and enhancement.

Simpler Scanner Tricks

More simply, you can bring your scanner image or MacPaint document into Silicon Beach's SuperPaint, Zedcor's DeskPaint, or Mindscape's Graphics Works 1.1 to retouch fine details using their LaserBits feature to clean up the image at 300 dots per inch. This gives you FatBits-style control at the LaserWriter's high resolution.

Remember, too, that from many software programs you can use the Smoothing option for printing on the LaserWriter. This will often print better looking bit-mapped graphics, but try it both ways. Sometimes, smoothing won't result in an improvement, especially with 300 dot per inch scanned images or dithered files. With 72 dot per inch graphics (MacPaint, etc.), be sure to set the scaling to 96 percent or use the Exact Bitmap Alignment option to better match the LaserWriter's resolution.

Scaling images to less than 25 percent of their original size will not always result in a better printed image. Some of the dots will be lost as a result of the severe compression.

Another "smoothing" trick that's very useful is simply making a photocopy of your laser printout. The mere act of photocopying will deepen the blacks and form cleaner, smoother edges on text and graphics. Printing from a stat camera will also improve the appearance of the image.

On the PC, you can capture Lotus 1-2-3 and other graphics by using SymSoft's HotShot screen image dump software to create a PostScript file that can be moved into page layout programs and the like.

Color, Too

You can also produce color transprencies for your next big meeting. Color LaserWriter and LaserWriter Plus toner cartridges can be obtained from Comtrex, Toner Research, or The Laser Connection. They can be used to print from software that allows the separation of color images. The same transparency stock can be run through the printer until all the colors have printed. There is a clear danger of remelting previously laid toner, so make sure that you're not gumming up the inside fuser section of the LaserWriter with these multiple passes. The printer wasn't really designed for this kind of use. You may first want to try making each color as a separate transparency and then stacking them into a four color unit.

Overhead color transparencies can also be prepared from laser printouts by using the Omnicrom 2000 Presentation System or the KroyKolor heat transfer laminating machines to bond color film to the laser print. Toner

Research also markets a thermal transfer device to prepare color overheads from laser printouts.

Your LaserWriter is capable of an almost infinite variety of graphics. Its PostScript capabilities take you farther than any other printing device ever conceived. This is especially true if you intend to use it for publishing, which is really what it's designed to do. Desktop publishers, read on.

CHAPTER **NINE**

Publishing With Your LaserWriter

PostScript Powers the Process

Add Graphics and Mix Well

Buffers and Spoolers

The Typesetter Connection

Rare are the occasions when several independent developments converge to create something really new, but that's exactly what happened when the Macintosh, LaserWriter, PostScript, and PageMaker all blossomed from the same seedbed, creating an entirely new application for personal computers—desktop publishing.

Before such developments, computers had a set, fixed screen font. They just displayed the same character set, which really wasn't readily changeable by the user. If you didn't like it, too bad. It was also monospaced, just like a typewriter font. Then came the Lisa and its little brother, the Mac. No, the fonts were not typographically pure, but not too far off the mark.

The technical evolution required lots of changes inside the computer. For example, the screen had to be totally graphic. Most had been strictly text, or ASCII, screens and were line-oriented.

Laser printers were coming into the market at about the same time. You could print different typefaces using plug-in cartridges, but on traditional computers, you didn't see a representation of the typeface on the screen. It is true that you could design screen fonts for use on a graphics monitor and then print them on a laser printer as graphics, which would give you some variety and allow you to see on the screen what you would get from the printer, but you would still need a new bit-mapped font for every size you planned to use. If that's all that had developed, desktop publishing probably wouldn't have happened. In fact, we're now beginning to see the difficulties of trying to use standard laser printers and bit-mapped fonts for this extremely demanding application.

For several years, PC users have envied Macintosh desktop publishing. Now, they're being told they can have it also, and all they need is some special software with their PC along with any old laser printer. No wonder there's a lot of disillusioned PC people out there. They've tried desktop publishing and found it to be difficult and not very rewarding. Slowly, however, things on the PC side of the world are getting better. Nevertheless, PCs will still lag behind the Macintosh for a long time because the Mac was designed with many of the basics of typography and graphics built in.

If publishing is your interest in computers, there are a number of things that you can do to help yourself along. First, take a really serious look at a Macintosh II and LaserWriter II NT, even if you already have a room full of PCs. The cost of a Mac II can be easily justified on the basis of the time you will save in getting the system working and producing. People are enthusias-

tic about the Macintosh for a reason. They're not all crazy—the machine is simply more productive and doesn't complicate the work you have to do. That is, of course, the way computers are supposed to be, but most aren't. The Macintosh is much more than just cute little icons and a mouse. Proficient users of the Macintosh recognize that the smooth, seamless integration of data transferred between quite different programs, the ready availability of extremely useful add-on desk accessories, the ability to have a great many fonts on call, and the convenient shielding of the user from the operating system allow them to achieve significant quality and gains in productivity. Most such users are zealots because they've discovered a system that helps them work rather than a system that gets in the way.

Second, you should consider finding out more about ongoing sources of information about this explosive field. Several fine magazines are available, including *Publish!* and *Personal Publishing*. There's also an association dedicated to desktop publishing, which is, after all, the mark of a true success. Desktop publishing has definitely arrived. Contact the National Association of Desktop Publishers (Box 508, Kenmore Station, Boston, MA 02215-9998) for membership information. It offers an electronic bulletin board and roundtable, along with a wide variety of fonts, software, templates, and artwork that can be downloaded by members.

Lots of things must be just right in order for desktop publishing to be easy and useful. PostScript is a big part of that picture, and the LaserWriters are a great way to have PostScript at your fingertips. Apple has designed them for publishing. In fact, the LaserWriter II NTX, with its capability of storing hundreds of fonts on a hard disk and with enough memory for the most complex graphics, is just the thing for a publishing group.

PostScript Powers the Process

If you're interested in publishing with your system, make sure you do the wise thing and plan for the future—purchase a PostScript printer like Apple's LaserWriter II NT or NTX.

If publishing is a serious business with you, then you'll probably quickly appreciate the added power of the LaserWriter II NTX. It's faster, it has the capability of adding a hard disk to store lots of fonts, and it can have enough memory to hold fonts that are already calculated and scaled (called "font caching") so they don't have to be recalculated each time you want to use them. The LaserWriter II NTX really speeds up the printing process, which is important when many people are networked into a LaserWriter. Make sure, however, that the hard disk you add works with the printer; some models do not. This is not Apple's fault; some hard disk manufacturers haven't implemented the SCSI wiring exactly as it should be.

Desktop publishing is headed one way—toward more power and more features. Cheaper laser printers may just squeek by today, but they won't let you in on tomorrow's power.

PostScript is an investment; it's as simple as that. It's also a good investment because virtually all the major companies involved with computer-aided publishing have given it their endorsement. There are many good reasons for this, and perhaps the most important is its flexibility in the face of future developments. PostScript, in its present state, is quite mature as far as its features and capabilities are concerned. There is still room for some increase in the speed with which PostScript runs and is interpreted, but its capabilities are already evolved. There's practically nothing you can't do to text and graphics on a page with PostScript powering the process.

Drawing with PostScript

Here's a strong recommendation to desktop publishers who are interested in getting some really super effects into their documents: read Chapter Eleven. It's about PostScript and what you can do with it. No, you don't need to be a programmer. You'll learn about PostScript software that will dazzle you with special effects and ease of use. Don't be afraid of PostScript!

If you're interested in obtaining the ultimate in graphics, invest in a PostScript graphics program such as Abobe's Illustrator, Cricket's Cricket Draw, Laserware's LaserPaint, or Aldus's FreeHand. These programs work with PostScript directly to provide extremely precise control over graphic elements.

Adobe's Illustrator is perhaps best utilized with a scanned-in bit-map image used as a template. The newest version, Illustrator 88, allows you to create your own bit-mapped template. From there, points may be connected as Bezier curves which mathematically link together to produce smooth curves and lines. MacDraw files can also be used in Adobe Illustrator, if you have Xris-Xros, from Taylored Graphics, which will take any PICT format drawing from MacDraw and the like and convert it to Illustrator format for enhancement within Illustrator.

LaserPaint is an integrated program containing draw, paint, text, and paste-up modes. The bit-map mode can be used at 600 dots per inch and has a variable airbrush feature. Text fonts up to 500 points are also provided, and text may be curved or flowed along any predefined path. Each element can be assigned a color, and the resulting color separations can be printed separately on the LaserWriter or Linotronic. Complete color control is provided with the Pantone color scheme used in four color printing.

Pantone color drawing is also a feature of FreeHand by Aldus. With the advent of color on the Mac II, color is being brought into a great many Macintosh graphics programs. Most are adding it to allow the printing of color separations on the LaserWriter or Linotronic.

One three-dimensional MS-DOS color drawing package that outputs PostScript or Windows Metafile (PICT) format files is Pro3D by Enabling Technologies. These files can be imported into most desktop publishing software. Windows Graph and Designer from Micrografx are other high quality drawing and illustration programs that will be an asset for PC publishers.

If you're serious about PostScript output from your PC-based publishing system, look into Renaissance GRX's Legacy II Switching Adapter and its Rendition I Advanced Graphics Controller. This combination will let you see on the PC screen just what will print from the LaserWriter.

Furthermore, keep the quality of your clip art as high as possible by using PostScript clip art such as Olduvai's Post-ART, ClickArt Postscript Images by T/Maker, and the others mentioned in Chapter Eight.

PostScript Comes in Handy Capsules, Too

You'll also be working with a new file format called "Encapsulated PostScript format," or EPSF for short. This file format is an important standard for data exchange between applications and between computers and their peripherals. Here's what it's all about.

Pure PostScript files are text files that mathematically describe the image. On the Macintosh and IBM-PC, PostScript isn't seen on the monitor. On the Mac, you see a QuickDraw representation of an image which is then converted to PostScript just before printing. The Mac's screen can't show PostScript, nor can the PC. You might see it as text or as nothing, but you won't see the image.

So what can be done when a PostScript drawing tool is used to create a piece of artwork, or when you create an effect using PostScript programming, such as rotating an image? Before EPSF was developed, you wouldn't see it until it was printed. That bothered the people at Aldus and Adobe, and so they set out jointly to develop a PostScript file that incorporated a bitmapped or object-oriented representation for screen display. Hence, you can place EPSF files in a page layout and see an approximation of the actual image. Without the extra screen file attached, you couldn't really see what your finished layout would look like until you printed it out. Keep in mind that with the extra screen file tagging along, EPSF files tend to be rather large. A comparison of file sizes is shown in Chapter Eleven.

If you wish to add graphics to your page layout from a program that doesn't create an EPSF file but will output PostScript, you are still in business. Let's look at an example.

Say you have an AutoCAD file that you place into your PageMaker layout. All you have to do is to save the AutoCAD file as PostScript by printing it to disk, then opening it with a word processor and adding the following text to the beginning:

```
%!PS-ADOBE-1.0
%%Title: PageMaker Document
%%Creator: PageMaker
%%Pages: (atend)
%%Bounding Box: 0 0 611 791
%%Endcomments
```

This addition converts a straight PostScript file into an EPSF file without the bit-mapped screen representation. Thus it may be placed in your Mac or IBM page layout software, but it won't be seen on the screen. All you will see is a box with this header text in it. Don't worry, though, you'll see your graphic when it prints out of the LaserWriter.

Doing this, you have entered the world of PostScript programming. It's really safe and easy. You'll see more about it in Chapter Eleven.

Add Graphics and Mix Well

Graphics are a key component in any eye-catching publication, and your LaserWriter is the ideal printer to do justice to your efforts, but before you start, make certain that you've given yourself the very best chances for success with the right computer hardware. This means memory.

Graphics are memory hogs. There's no other way to put it. Install the most RAM you can afford and invest in a sizeable hard disk. Scanner files, for example, will fill your computer's memory right up to the brim, even if you have more than a megabyte. Many won't even work with a 512K Mac. Put four megabytes in if you can. Otherwise you may have to scan sections separately and physically cut and paste them together.

If you can't afford the RAM upgrade, all is not lost. Just look for a scanner that spools the scan file to disk as it is input. AST's TurboScan scanner and SuperScan software will run on a 512K Mac, for example.

Add Video and Mix

More than just scanners are involved in graphics input. Comtrex's Imagizer video imaging system produces halftones from video camera input. Graphics are coded into PostScript, and the contrast and brightness may be independently controlled. The Imagizer also works with the Canon still video system to allow direct printing to the LaserWriter in a manner similar to "instant photography," and images can be enhanced with Letraset's ImageStudio gray-scale image editing software. Any standard video input—camera or VCR—can be used, but Comtrex's camera has a resolution of 750 lines or dots per inch, compared with the 250-line home video standard.

With the LaserWriter, Imagizer produces halftones in a 60-line screen, which is about newspaper photo quality. On the Linotronic 300, 133-line screens are produced, which is near the quality of magazine art. With optional color filters, the Imagizer, with the color cartridges for the LaserWriter and LaserWriter Plus that are available from Comtrex, can produce transparencies in the four colors used in professional color printing: yellow, cyan, magenta, and black.

If you need extremely high quality halftones for your publication, Knowledge Engineering's Lithographer software, when coupled with a compatible scanner and the Mac II, produces professional quality halftones from a typesetting device such as the Linotronic 100 or 300.

Getting Good Screen Dumps

If you're writing computer manuals, you might be interested in illustrating your work with pictures of the screen. With the PC, HotShot from Symsoft will create PostScript files from anything you can display on the monitor. The program allows you to assign gray scales to various colors and to add callouts, arrows, boxes, and comments to the screen shot. It will even take screen shots from Microsoft Windows and transfer images as encapsulated PostScript into the Macintosh or PC for inclusion into documents.

Note that the Mac II creates a MacPaint file with the screen dump procedure (Command-Shift-3) that will be rotated ninety degrees. Why is this? Well, the screen picture would be wider than a MacPaint document, so to get the entire 640 by 480 pixel image, there's a built-in rotation routine. Zedcor's DeskPaint desk accessory program will rotate it back for you if necessary. Also, be sure to set the Mac II Control Panel to two colors before making a screen dump. Otherwise, it won't work.

Capture, by Mainstay, is a handy utility for Mac screen dumps. It takes a snapshot of any portion of the screen image and saves it to the Clipboard or as a PICT file. Thus, the high quality PICT and color PICT images can be easily placed into other programs or printed in clean, accurate from from your LaserWriter.

Add Color, Too

With the Mac II, color has come to the Macintosh world, and color printing is available with Apple's ImageWriters or Hewlett-Packard's PaintJet ink jet printer. Coupled with a color graphics program such as PixelPaint from SuperMac Technologies or Modern Artist from Computer Friends, the Mac II can create some beautiful artwork.

For those uninitiated into the finer points of publishing, color printing is usually done by separately printing different colors, one over the other, to produce four color printing. The paper actually goes through the printing press four times or under four separate ink rollers to receive layers of cyan, magenta, yellow, and black.

In order to print each color layer, a separate single color master must be prepared. This master will have all of the area that will be printed in each color. To do this, you need to separate the colors into the four distinct components—a process called color separation.

Color separations can be printed on the LaserWriter from a number of page layout and graphics programs. You can use software such as Quark's XPress, Cricket's Cricket Draw, Aldus's FreeHand or LaserWare's LaserPaint to specify color, but what you get, of course, out of the LaserWriter or Linotronic are black and white separations that can then be used in the four color printing process described above.

Even if yours doesn't have a color separation mode, Computer Friends has Color-Sep, a program that will create a four-part PostScript file from a Mac screen image for producing color separations on a LaserWriter or Lintotronic. Engraver, from Image Express, also lets you create color separated files from many of the Macintosh formats, including PICT files. Images from AT&T's Targa Image Capture System can be converted into color separations on the LaserWriter or Linotronic with CyberResearch's CyberChrome PC-based workstation.

Adobe Illustrator, coupled with Adobe Separator software, also does color separations, and you'll be seeing a great deal of software in the future with this capability. The newest versions of MacDraw have a greatly expanded range of features, including the ability to create separate layers in different colors. Note, too, that Aldus's FreeHand produces color separated laser printouts.

Such color separated printouts will be in black and white, which is all right. The ink on the color press is where the color comes from; the separations are printed in black and white.

With these innovations, you can, for example, specify that the title of your newsletter be in one color with a border around the margin in another. This is called "spot color," which means that one area of the paper is printed in a different color. Perhaps you want your headline in red and the rest of the piece in black. Simply make a separate LaserWriter printout with the headline and tell your offset printer to run it in red.

Of course, the reason you settled on the Apple LaserWriter as your publishing printer is that you can get excellent business-grade printing masters from it, and when high quality is needed, the same file will generate a typeset version at 2,400 dots per inch.

This is also true of color separations. You can examine proof prints from the LaserWriter and then go for final typeset from your Linotronic. A good introduction to producing color separations from your Macintosh and LaserWriter is described in *Graphically Sound and Factually Fit: A Newpaper Guide to Information Graphics on the Apple Macintosh* by Steve Segal, who

works for the *Lawrence Eagle-Tribune*, in Lawrence, Massachusetts. It's modestly priced ($10 at the time of printing) and is available from Steve Segal, Graphics Department, *Lawrence Eagle-Tribune*, Box 100, Lawrence, MA 01842. A collection of very useful tips for using MacDraw and Cricket Draw is also included.

A Few Tips for Desktop Publishers

The first LaserWriters often produced a black that wasn't quite black enough. This problem doesn't plague the newer, low profile LaserWriter II models, but if you have an earlier printer, you don't have to be limited by the gray, washed out black tones of its printouts. Spraying the sheet with a fixative such as Krylon 1311 Matte Finish, Krylon 1303 Crystal Clear, or Blair Spray Fix 105S darkens the muddy parts of the printout into solid blacks. You could also buy "super-black" cartridges from Toner Research Inc.

Quality, in publishing, is important. That's why many newspaper people draw maps, graphs, diagramed news scenes, etc., at double the size they want and then print at a 50 percent reduction. This is a great way to sharpen an image and have credit lines print sharply in a clear 6-point type.

We've already talked about how bit-mapped graphics slow down your LaserWriter. They really slow the LaserWriter or Linotronic down when they are printed in a rotated, landscape mode. Other things can have the same effect—text in sizes larger than 20 points, for example, or using lots of patterns and shades. Even patterns that are hidden from view by another object placed on top will slow down the printer. It still has to calculate all the information for the hidden parts of the image. Try erasing and removing parts of an image when this is possible, rather than hiding them under an opaque object.

Remember, too, that the Smoothing option will slow things down even though it might improve the overall printed image. The Smoothing option is available on many Mac programs and is a feature of even a few PC programs such as Software Publishing's Personal Publisher. Try it if you have any bit-mapped fonts, logos, or graphics in your layout.

Using full justification or kerning for text also slows down a LaserWriter. A great many added calculations are required when character and word interspacing must be calculated and adjusted prior to printing.

Speed can be extremely important when larger publishing groups are using a networked LaserWriter. Here, you should be using TOPS or AppleShare with a good spooler (see below about buffers and spoolers). The next incremental jump in speed would be to go to EtherTalk, while retaining TOPS or AppleShare for the file sharing capability. You might be surprised at how much publishing functionality can be created when Mac IIs are coupled together through AppleTalk or EtherTalk interfaced with several LaserWriters for proofing, and a PostScript-Linotronic is used for final imagesetting.

Buffers and Spoolers

Computers compute very fast, but printers sometimes seem slow, especially when you're sitting there doing nothing while your computer feeds the document file to the printer. Your computer system is supposed to be a productivity enhancement tool rather than a "sit and wait" machine.

There are ways to speed up the transmission of data to the LaserWriter—putting the computer on an AppleTalk-type network, for example. Nevertheless, you still sit there while the two talk to each other. Adding memory to a LaserWriter II NTX will speed things up if you have one of these expandable marvels.

Even with AppleTalk doing the communicating, a better way to gain speed is through the use of buffers and spoolers. They don't speed up the actual printer mechanism, but they do let you get back to work faster. Here's the story.

Computers traditionally hold the file being printed and feed it to the printer as needed. With printers that do each character as they go along—daisy wheels and dot matrix types, for example—the computer can feed characters one at a time until the document is completely printed, and that's pretty much how it's done.

Printers often have an available memory area of their own that is set aside to receive text prior to printing. This is called a buffer. It's just a temporary holding area. Apple's ImageWriter, for example, will continue to print after you get back control of the computer which is printing from the contained buffer that normally holds about a page. You get back to using the computer a page earlier, which is not much, but it's something.

Your LaserWriter also has a memory area to store a page of information prior to printing. That's why the computer finishes the print job before the LaserWriter does.

There are a lot of differences between dot matrix printers and laser printers, however. Laser printers don't print character by character; they print the entire page at one time. Don't be fooled by the slow way the pages slide out. These printers are fast. They look slow only compared to a photocopier. The actual speed your LaserWriter is printing text is hundreds of characters per second. There's nothing second rate in that, and it's also letter quality.

Hardware Can Do the Trick

With a ten-page document, you might as well take a quick coffee break while the computer feeds to the printer, especially if you've included a healthy amount of bit-mapped graphics. Adding more memory to a LaserWriter NTX can speed things up rather dramatically, but with the LaserWriter Plus or II NT, you'll be sitting and waiting unless you buy a hardware buffer or use a software laser print spooler.

A buffer such as Ergotron's MacBufferLW, Dataspace's LaserServer, and Comp-Link's LaserBuffer is simply a memory storage device containing a powerful microprocessor along with a lot of RAM chips to hold your file temporarily and feed it to the printer. In essence, it imitates the Mac and does its printing work for it while you get to go back to work using the computer. As soon as you press OK on the LaserWriter print menu, the document is sent to the buffer. As soon as that's accomplished, your computer screen looks like everything's finished. You can now close the file, open another, and continue working.

The DataSpace model comes with 2MB standard and can be expanded to 12 MB. It also handles up to 32 users and can accept up to 32 print jobs simultaneously. Ergotron's buffer is available in 1, 2, 3, or 4MB models and handles an unlimited number of users.

Another solution to the problem is a print server. This arrangement uses a hard disk to act as the storage device for files waiting to be printed and incorporates spooling software to feed the printer. PLUS-Spool from MacPEAK Systems and the DiskBuffer from Comp-Link are examples of this arrangement for the Macintosh.

If you have an old PC-compatible with a hard disk around gathering dust, you can turn it into a LaserWriter buffer/printer server with Tangent Technologies' TangentSpool Kit that contains an AppleTalk interface card for the PC, along with software and cable to hook it into your system. Not a bad use for those old PCs!

In Chapter Four we discussed several ways in which PCs and Macs can be mixed with an Apple LaserWriter. Here is another. The Buffalo SX Buffer is a self-contained buffer-networking device that can link computers with a wide variety of printers including the LaserWriters. Up to nine computers can share a LaserWriter in this manner, and several of the buffers can be daisy-chained to link a large number of computers and printers together.

Software Can, Too

Even more popular are spoolers. If you're trying to figure out what the word means, it's an acronym for "shared peripheral operations on-line." Even that doesn't tell you enough, though.

Spoolers are useful software programs that will take your files for printing and set aside a part of your disk space as a holding area for them. They then release the computer back to you so you can continue to work and begin to feed the printer in the "background." Printing continues until all of the document files are finished, and during that time you've been using your computer for other things, which represents real productivity enhancement.

You can use a spooler even if you don't have a hard disk, but the extra storage space of a hard disk will make life far more pleasant. If you are using a system with diskettes only, look for spooler software that is itself small in

its memory requirements. Some, such as SuperMac's SuperLaserSpool, have modest space appetites, and their spooled files are relatively small. There's a reason for this.

When the Macintosh works on files, it's using the built-in QuickDraw commands that are designed into the basic structure of the Macintosh. These are pre-inventoried commands, graphics, and other routines that save vast amounts of computing time and keep document storage files compact. QuickDraw is one of the "secrets" that makes the Mac the unique computer that it is.

Your LaserWriter, however, speaks a different language, PostScript. So there has to be a conversion from QuickDraw to PostScript, which takes time and also disk space. PostScript files are larger—often much larger.

SuperLaserSpool stores the spooled files as QuickDraw and converts them to PostScript format only just before printing. Most other spoolers, such as Think Technologies' LaserSpeed and InfoSphere's LaserServe, do the converting first and then store the files as PostScript for later printing. So when disk space is important, look for spooler software that stores spooled files as QuickDraw. They're usually faster when spooling, too. Despooling speed—that is, how fast they send files to the printer—is often a moot point. What most people care about is how quickly they, personally, are rid of the printing job.

Spooler software comes with all kinds of different features. Some are bundled with hard disk storage devices; others, such as Apple's AppleShare Print Server, come as part of a network software package, and you can buy many as separate packages. Most have been developed for the Macintosh, but Tangent Technologies' PCMacSpool will spool LaserWriter files from a PC connected into an AppleTalk network. Apple also has a laser spooler, Background Printing, as part of the MultiFinder package that comes with the Macintosh.

Most spoolers are available in either a single user version or in a multiuser configuration that handles up to five users for about three to five times the cost of the single user version. Tangent also has a spooler that offers multiple LaserWriter support for multiusers with Macs or PCs, and each user can choose from as many as eight different networked LaserWriters.

Designing buffer hardware and spooler software for the Mac and LaserWriter is a very difficult task because the Macintosh and its peripherals are intelligent, that is, they talk to each other and exchange information.

You've seen various comments appear on your screen from time to time—messages like "Looking for LaserWriter," "Preparing data," and others. The LaserWriter may even flash a help message back to the Mac, saying it's jammed, or out of memory, or out of paper. These are smart machines, and putting something in between them can be very tricky indeed.

What if the LaserWriter doesn't have enough memory to print a certain page or if the paper tray is empty? The spooler had better interrupt your work back there on the computer to tell you, and this has all got to be able to work through AppleTalk. Now you're probably starting to see why spooler software took over a year to become available after the introduction of the LaserWriter.

A Buyer's Checklist for Buffers and Spoolers

Here's what to look for when you consider adding a laser spooler or buffer to your productivity-enhancing Macintosh system:

- Your LaserWriter has fonts already built in, but if you want to use any others, make certain that your choice in a spooler software or buffer handles downloading of disk-based fonts, and find out whether the downloading is manual or automatic. DataSpace's LaserServer buffer can be purchased with its own hard disk for storing a complete library of downloadable fonts—a real plus for a networked publishing group, for instance.
- If the LaserWriter serves more than one or two computers, you should have some way to direct and modify the flow of "traffic" to the printer. This is called "queue management" and allows the lineup of the documents waiting to be printed to be altered. A rush job can thus be moved up to the front of the line. Look, too, for the ability to delete documents from the queue when necessary.
- Cost can be a consideration, too. Spoolers are almost always cheaper than buffers, but if your LaserWriter is shared between a number of users, buying spooler software for each user can add up even with multiuser versions. Perhaps a hardware buffer will prove to be more cost-effective when larger work groups share a single LaserWriter.
- How about manual paper feed? If you've used the handfeed paper feature of your LaserWriter, you already know that the printer talks to the Mac and to you, telling you when to do certain things. Make certain that the LaserWriter can talk through the spooler or buffer and interrupt the Mac for these important and timely messages.
- Memory consumption can be a problem with some spoolers, especially if your system uses 3 1/2 inch diskettes and has a megabyte or less of memory. With four megabytes of RAM and an 80-megabyte hard disk, you really won't care.
- Some spoolers and buffers will also function with the ImageWriter, and others won't. If you plan on using both types of printer, look for this dual feature.

- Will the spooler work with files from more than one application at a time? Most will, but be warned that there are products that require that you wait until all MacWrite documents are printed before you can send a PageMaker or GraphicsWorks 1.1 file to the spooler.
- Will the spooler work with the networking scheme you have installed? MacPeak's PLUS-Spool hardware/software print server, for example, is designed specifically to function with a LocalTalk network.

The following software spoolers are available by system.

- Macintosh: LaserExpress (Gestetner), LaserServe (InfoSphere), Background Printing and AppleShare Print Server (Apple Computer), LaserSpeed (Think Technologies), LaserSprint (Warp Nine Engineering), MacSpool (Tangent Technologies), NetPrint (TOPS), SuperLaserSpool (SuperMac Software)
- MS-DOS: Lasertorq (Laser Tools), NetPrint (TOPS), PCMacSpool (Tangent Technologies)
- VMS: AlisaTalk Printing System (Alisa Systems), pcLINK (Pacer Software)
- UNIX: K-SPOOL (Kinetics)

Actually speeding up the LaserWriter isn't easy. Upgrading a LaserWriter II NT to the NTX configuration or adding memory to the NTX will quicken the pace of printing. Other than that, the internal laser marking engine that Apple buys from Canon is the limiting factor on actual printing speed. You can speed up the transfer of data to the LaserWriter as we saw earlier in Chapter Three, and you can consider speeding things up using ultra high speed data transmission through networks such as Ethernet that we described in Chapter Four.

You'll see the greatest personal benefit when you begin to use buffers and spoolers. Speed and time are in the eye of the beholder, and although printed copies won't issue forth from the LaserWriter any faster, you'll be free from the most tedious part of the process of printing—the waiting in front of a nonproductive computer screen.

The Typesetter Connection

One of the greatest advantages of PostScript is its ability to produce output from a wide variety of printers and typesetters in a wide variety of resolutions. This means you can easily turn your laser-printed creations into super-high quality typeset versions quickly and with a minimum of fuss. That may not sound like much, but it's a key point to PostScript. Your laser-printed

document can be just as readily typeset at very high quality. All it needs is your decision. Here's what it's all about.

Laser—Already Good Enough?

First of all, we're going to be talking about putting your documents through a PostScript typesetter for high quality printing, but before you think you need typeset quality for everything, take a good, clean LaserWriter printout to a printing company you trust, one that has given you good work in the past. Tell them you need the best printed quality you can get from it and leave the rest to them. You may be very pleasantly surprised at the appearance of the finished job. Certainly the quality won't be as good as if the document had been typeset, but to the unaided eye (only typesetters and art directors read with magnifying glasses) the quality will often suffice. Here's why.

When you look at the laser print closely, you see tiny imperfections along the edges of letters and a very light "spray" or "mist" of toner all over the page. Well, few things in life are perfect, even laser printers, but in the hands of a good printer, the image can be enhanced by altering the "burn" of the plate—that is, the exposure. You'll see all the tiny specks of toner disappear, and the edges of text characters and graphics will sharpen up considerably.

I have seen examples of offset printed brochures taken directly from LaserWriter printouts that, to the business reader, look as good as if they were typeset. After all, are you printing them for a purist typesetter to read? Remember that your audience—the most important factor in the entire process—most likely won't see the difference, and that you gain two big advantages: a considerable cost savings and an increase in the efficiency of the entire document production process.

You can also try keeping both your budget in line and the final printed quality high by designing your pages at twice their normal size and having your offset printer photographically reduce them to normal size before printing.

Nevertheless, there may be times when you need the look that high resolution typesetting will bring.

Where to Go for Typesetting

Before we get into the details of producing typeset material from your documents, let's consider who will do your typesetting and where it will get done. You have several choices.

First, you have the choice of output quality, or resolution. There are three basic typesetter resolutions available today.

Although this is a bit of heresy to members of the more conventional members of the typsetting community, there is 600 dot per inch PostScript laser

printing as Varityper's VT600 laser printer becomes more and more available. Many typesetters claim that nothing under 1,000 dots per inch should ever be considered typeset but beauty is in the eye of the beholder. Theoretically, 600 dots per inch means four times the image quality that comes from a LaserWriter. (You may think it's double the resolution. It is, but in only one direction. You have to multiply it by two. LaserWriters produce 90,000 dots per square inch while the Varitypers produce 360,000 in each square inch.) Actually, the image quality from a Varityper VT600 won't be quite four times as good as the LaserWriter's because the individual dots aren't exactly four times smaller. The Varityper does use a toner having a smaller particle size and has a very high quality imaging drum so that most of the increased resolution is seen in the resulting finished output. For the printing of many business documents, you may be quite well off with an output of 600 dots per inch.

Next up in quality is the Allied Linotronic 100, which will give excellent results for almost every application. The resolution of the Linotronic 100 is 1,270 lines per inch, which you can think of as being equivalent to dots per inch. The resolution, in dots, is 1,600,000 dots per square inch versus the LaserWriter's 90,000—almost 18 times greater. Resolutions of 635 dots per inch can also be generated from the Model 100.

The ultimate in quality is the Linotronic 300 at up to 2,540 lines per inch, which is equivalent to 6,450,000 dots per square inch. The quality from this machine is beautiful, but remember, the greater the resolution, the slower the job runs. Be prepared for a wait, and most typesetting firms are charging hourly rates on top of output rates. A Linotronic 300 can also produce output at 1,270 dots per inch, so you can have the choice of very high resolution or the same quality as the Linotronic 100 produces. Usually, the lower resolution output at 1,270 dots per inch will be most satisfactory.

Remember, too, that the Linotronics are not just typesetters that produce rows and rows of type for you to paste up the old fashioned way. No, these are imagesetters. They produce everything—text, borders and rules, and graphics—in high quality. Essentially, they set the entire layout, not just the type. In effect, they're "super LaserWriters."

Since typesetting does cost significantly more than laser printing, it makes good sense to proof your work first on a LaserWriter before spending money on typesetting.

There is probably a typesetting service near you that has a PostScript Linotronic or Varityper VT600. You can simply take a disk with the files to be typeset and have them done. Today, even many small communities have an "instant" print shop or copy shop that offers this service. You can usually track one down by asking your local Apple dealer or by looking in the local Yellow Pages.

However, with modern telecommunications, you don't have to be near the typesetter. All you need is a modem and a telephone. There are many service bureaus that will receive your files twenty-four hours a day via modem and send you the finished typset output by an overnight express delivery service. You don't even have to see who you're doing business with. Most will also receive disks via express.

Which is better? Well, if you're just beginning and have a local typesetting service near you, try it first. The procedure is really quite simple, but there can be a few tricks to getting exactly what you want. There are a few possible pitfalls. For example, making any changes in your document can be a problem for the typesetting service, especially if it is not local.

A Few Details About Typesetting

In general, here's what to expect.

First, the Linotronics work in a fashion different from the LaserWriter. They're both PostScript imaging devices, but the Linotronic produces its output on photographic paper or film, and it can print the image all the way to the edge of the paper. Your LaserWriter can't print beyond 8.0 and 10.78 inches on standard, letter-sized paper.

Second, the Linotronic doesn't smooth bit-mapped graphics like the Macintosh does on the LaserWriter. Thus, 72 dot per inch bit-mapped graphics can often look better from the LaserWriter than from the Linotronic.

Third, watch your system and software for possible problems, especially if you are using a typeface that must be downloaded. You'll want to make sure the Linotronic has the fonts you want. This includes making sure the typesetting bureau has the same typeface families you have used. Include them on the diskette, along with any downloadable typefaces, to make certain everything works the first time around.

Other problems can also occur. For example, if you are using MacDraw, you might need to supply your own System file because MacDraw doesn't use the normal font numbers; it keeps track of fonts by the order in which they were originally installed. Chances are that your typesetting bureau didn't follow the same order.

If you're using a PC, save the files in your application's normal method and as PostScript using your software's print-to-disk option. This will make things easier on the typesetter's end. There is a drawback, however. The typesetting service, unless it happens to have the same software that you used to create your PC document, can't make any changes or adjustments. Such changes will have to be done by you, which is another reason you may want to consider investing in a computer like the Macintosh that has been designed for accurate placement of text and graphics.

There are also some output differences that you should be aware of before you have your files typeset. The Macintosh uses 1/72 inch wide lines to represent hairline rules on the screen. The LaserWriter prints it at 1/300 inch, and the Linotronic 100 will print it at 1/1,200 inch. When you are going to a Linotronic, you should choose wider rules. For the same reason, outline type prints very light on the Linotronic. You will want to avoid using the outline style.

Watch gray screens, too. They usually print differently depending on whether you're using a LaserWriter or Linotronic. On the Linotronic, light grays are printed lighter, and dark grays reproduce darker. Stick to screens that are between 20 percent and 90 percent density for best results.

Please remember that you're using proportional type. Forget the old typewriter trick of spacing over rather than using tabs. All you'll get by using the spacebar is a lot of wavy columns of type. Always use tabs.

Consider using the new options on the latest versions of LaserWriter driver with your Linotronic. You can, for example, reverse or "invert" the image and then flip it horizontally when you use photographic film rather than photographic paper in the typesetter. This will give you a "reverse image master" for printing.

Money-Saving Tips, Too

There are a few tips for processing your documents on a Linotronic, especially to keep expenses down (time costs money on a Linotronic). For example, use object-oriented graphics instead of bit-mapped when possible, and keep graphics from overlapping as much as possible. Only the top one will print, but the typesetter must image everything, even the part that is hidden and won't be used in the final image.

You can see the difference in the amount of raw data that must be processed from bit-mapped graphics as opposed to object-oriented ones in the comparison of file sizes in Chapter Eleven. The larger the file, the longer it takes the Linotronic to process.

If you do have the bit-mapped kind, print the file straight to disk by typing Command-F immediately after you select Print on the LaserWriter print menu. You will see a message saying "Writing PostScript to file PostScript 0." This is a text-only file that describes your document in the PostScript language. Do this before you go to the typesetter, rather than waste the Linotronic time necessary for the translation from QuickDraw to PostScript. Then send the PostScript file, already-translated, to the Linotronic by using the PostScript dump utility described in Chapter Eleven.

When you give your disk to a typsetting service, please tell them if you have created the document using a Mac containing the original 64K ROM.

This will be any Mac 128K or Mac 512K that still has the internal 400K disk drive. The typesetting service may have a special procedure to correct for character spacing.

Using Non-PostScript Typesetters

Not everyone has access to a typesetter equipped with PostScript. If you already have another kind of typesetter, there are file translation programs that will convert PostScript into many of the typesetting codes that run the major typesetters.

For example, PostCode from Mumford Micro Systems runs a Compugraphic MCS typesetter from any of the Macintosh software. Thus, if you already have an MCS typesetter, you can have Macintoshes as the front end, using off-the-shelf Mac software, proof your work on a LaserWriter, convert the PostScript to MCS code, and typeset from a Compugraphic machine. PostCode will print Macintosh graphics from the Compugraphic 8000 and 8400 models.

In a similar fashion, The Typesetter's Connection: Windows from The 'Puter Group will translate PC PageMaker files into MCS code.

Using another approach to the problem, Compugraphic has issued a new hardware/software package, CG Script, that takes PostScript files from your Mac or PC and converts the PostScript code into Compugraphic typesetter language. Graphics, as well as type, can be output from the Compugraphic 8000 and 8400 phototypesetter units and the 9600 and 9700 imagesetters.

IBM-PC users can send their Ventura or PageMaker PostScript files to a Varityper Comp/Edit or Epics typesetter using Dagra/Set's Dagra/Set software.

If you have an Itek Digitek typesetter, your Mac's PostScript files can be translated using Digitek PST from Itek Graphics.

In addition, a number of PC-based publishing systems are coming out with PostScript capabilities. For example, the Ultimate Professional Publishing System from Composition Technologies uses the IBM-PC/XT and AT as a platform to drive a wide variety of PostScript and non-PostScript typesetters and can readily use a LaserWriter for routine output or proofs.

The Kodak Ektaprint Electronic Publishing System (KEEPS) can be configured with a PostScript driver so that files may be proofed on a LaserWriter before printing on a Linotronic.

Using a costly typesetter efficiently increases productivity and profit. Adding a print spooler to your Linotronic evens out the flow of print jobs and keeps everything running smoothly. Tangent Technologies' TangentSpool, running on the hard disk of a low-cost PC clone, manages the printing jobs while you continue to work on other things.

Quality is yours whenever you need it; it's as simple as that. LaserWriter output, used directly as printing masters, is changing the way businesses use

the printed word and image. It's simple, quick, inexpensive, and you have total control of the entire process.

Higher quality isn't much harder to achieve. All you need is a modem or disk and a Linotronic typesetting service. Virtually all your publishing needs are at hand.

Like Gutenberg's invention of moveable type, the "resolution-revolution" of desktop publishing is changing the way people do things. Life will never be quite the same, but aren't you glad you're part of it?

Publishing on LaserWriters is state-of-the-art and makes you the master of the written word and the drawn image. There's power in publishing, and today, it's in the hands of the people.

CHAPTER **TEN**

Software and Your LaserWriter

Macintosh Software

MS-DOS Software

Software for the Apple II

Software for the Atari ST

Software for the Commodore Amiga

Minis, Mainframes, and Miscellaneous Systems

The point has been made before but here it is again: The LaserWriter isn't just a Macintosh printer. It's the perfect partner for a Mac (or lots of Macs), and it's also a great output device for everything from Apple IIs to mainframes.

Much of the reason for this is the PostScript language that runs on the LaserWriter. PostScript is a computer language that uses text—words, letters, and numbers—to describe and do things.

In effect, any computer can work with PostScript, and the great richness of capabilities for manipulating text and graphics that derives from the PostScript language has accounted for the popularity of the LaserWriter with many non-Mac systems. It's just about the perfect printer for complex tasks such as those that involve graphics or precisely formatted documents. You can even get halftones and gray screens.

With all this printing excellence, you're consequently going to find more and more software that uses PostScript devices such as the LaserWriter. Below are some of the less well-known programs that tap the power of the LaserWriter.

In this chapter, the company names and addresses are listed for each program unless they are given in Appendix C (Sources for Products Mentioned). This will keep Appendix C from becoming overloaded and more difficult to use.

Macintosh Software

Of course, no one in his right mind would develop Mac business software without the ability to print on the LaserWriter. If you're a Mac user, you already know most of the very popular packages that run on the Mac-LaserWriter combination. The purpose here will be to aquaint you briefly with some of the lesser known gems that you may have missed along the way.

Before we get into specific categories of software, let's consider one program that is extremely useful, yet somewhat hard to classify: SuperGlue from Solutions International (29 Main St., Montpelier, VT 05602, [802] 229-9146). SuperGlue isn't a PostScript program; it's based on Apple's QuickDraw routines that operate in most of the Macintosh software. SuperGlue is a program that allows a file from any program that uses the QuickDraw routines to be saved to disk in QuickDraw format. This means that you can take multi-page documents like spreadsheets, graphs, and charts from the

programs that have created them and import them into your word processor or page layout program.

If this strikes you as a simple replacement for the Clipboard or Scrapbook, think again. SuperGlue isn't restricted to images the size of the Mac's screen, and with a viewing program supplied with SuperGlue, you can send files to another Mac user, who can read and print the files. They can't change them, however. That takes the original creating application. In a way, SuperGlue is a "compatibilizer" that allows an ordinary word processor to read and accept files from graphics programs in a manner similar to the way page layout programs do it.

Another helpful program is Preview (COMPUTER:applications Inc., 12813 Lindley Dr., Raleigh, NC 27164, [919] 846-1411). If you've ever used an application such as Microsoft Word or Write that has a page preview mode to let you see what things will look like *before* you print, you know that a page preview can save lots of frustration. Well, here's a preview mode that works with most Mac applications, even for software that never even thought of having a preview mode.

Text Processing

All the Macintosh word processors are LaserWriter-compatible, and some, such as WordPerfect's WordPerfect, Ashton-Tate's FullWrite Professional and Microsoft Word allow fine typographical adjustments, including changing the line spacing in increments of one point or less. In addition, FullWrite contains a drawing mode for adding high quality object-oriented graphics to your documents. It also has quite a number of other features generally found in page layout software. If you need heavy-duty word processing with some page layout ability, look into this one.

You may have missed LaserLabels (Perimeter Software, 1608 N. Milwaukee Ave., Chicago, IL 60647, [312] 278-9509) for printing 3 1/2-inch diskette labels on your LaserWriter using self-adhesive stock.

The creation of usable office forms is another great application of the Mac/LaserWriter combination. With Fast Forms (Shana Enterprises Inc., 9650 Twentieth Avenue, No. 105, Edmonton, Alberta, Canada T6N IGI, [403] 463-3330), you can create a wide variety of forms that can then accept data input from an included desk accessory program. The data can also be exported into other programs, including data bases. Gray screens, hairlines, custom vertical and horizontal grids, and printing and non-printing areas are features of Fast Forms.

MegaForm (Megahaus Corp., 5703 Oberlin Dr., San Diego, CA 92121, [619] 450-1230) and FormDesign (Clearview Software, Box 3294, Providence, RI 02906, [401] 351-1930) are very full-featured business form design and generation packages that you can use with your Mac/LaserWriter to create

useful office forms. Claris also offers SmartForms, a business form design package.

Several pre-drawn business form collections are also available: DrawForms (Computer Productions Unlimited Inc., 78 Bridge St., Newburgh, NY 12550, [914] 565-6262); MacFill-In (Cognitive Concepts, 1219 Phelps Ave., San Jose, CA 95117, [408] 243-6886); and SoftForms (Artsci, 5547 Satsuma Ave. North Hollywood, CA 91601, [818] 985-2922).

Graphics Software

Most Macintosh users are already familiar with a number of graphics packages for the Mac. We will simply note, concerning some of the more common ones, Silicon Beach's SuperPaint, Mindscape's Graphics Works 1.1, and Deneba's Canvas, that they contain the capability to produce both bit-mapped and object-oriented images. Canvas from Deneba and Zedcor's DeskPaint are in a useful desk accessory format.

If you're a heavy MacDraw user, look into Sizer and Adjacency from Johnson & Johnson Design/Build. These two MacDraw-specific desk accessories will add several functions that you may find very useful. Since they install directly into the application, they are not cluttering up your DA menu when you are using other programs. The software provides keyboard equivalents for all MacDraw functions. Sizer shows the dimensions of any selected object and allows new values to be entered to modify the object. Adjacency causes selected objects to move together until their nearest sides touch and their edges coincide. One object can be locked to move the other toward it.

Among the high-end PostScript drawing programs are Adobe Illustrator, Laserware's LaserPaint, Supermac's PixelPaint, Aldus's FreeHand, and Cricket's Cricket Draw. As we mentioned in Chapter Eight, Xris-Xros from Taylored Graphics will convert any PICT file drawing to Illustrator format for enhancement. It will also bring word processing files into Illustrator. In addition, Taylored Graphics' QuikPlot.PS software plots Illustrator files on color pen plotters.

There are a number of Mac programs designed to create presentation graphics: for example, Mindscape's GraphicsWorks 1.1, Cricket's Cricket Presents, Microsoft Chart, and PowerPoint, and Symantec's More (Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014, [408] 253-9600).

If you've been using graphics for a while, you may have run into the problem of keeping track of them and remembering each kind of format and the contents of each file. For every problem, there's usually a program to help solve it, and the cataloging of graphics files can be done with The Curator by Solutions International, with PictureBase (Symmetry Corp., 761 E. University Dr., Mesa, AZ 85203, [602] 844-2199 or [800] 624-2485), and with

Graphidex by Brainpower. Each shows a mini-view of the selected file, and The Curator works with a very wide variety of file formats, including TIFF and EPSF (Mac and IBM), in addition to MacPaint-style bit-mapped images and MacDraw-style PICT formats. Graphidex catalogs the latter two types of files and also allows direct editing of the image without having to use the originating application program.

Page Layout Software

TeXtures (Addison-Wesley Publishing Co., Jacob Way, Reading, MA 01867, [617] 944-6795) is a Mac version of the popular TeX typesetting program and language developed at Stanford University by Donald Knuth. TeXtures also integrates text with graphics image handling, and because TeX is an ASCII text language like PostScript, files may be transferred among many different kinds of computers. TeXtures is not WYSIWYG. The user types format control commands directly into the document. There is a preview function, however, to let you view the results before printing on a LaserWriter or a typesetter. TeXtures, unlike many of the popular Macintosh page layout programs, is best used for long documents that have fairly standard formatting requirements—textbooks and the like. Another Mac version of TeX is Mac TeX (FTL Systems Inc., 234 Eglington Ave. East, #205, Toronto, Ontario M4P 1K5, [416] 487-2142).

Miscellaneous Macintosh Software

Music scores print beautifully on the LaserWriters when you have Adobe's Sonata font installed. Here are several programs that will bring music to your ears and your printer: ConcertWare Plus (Great Wave Software, Box 5847, Stanford, CA 94305, [415] 325-2202); DeluxeMusic Construction Set (Electronic Arts, Box 7530, San Mateo, CA 94403, [415] 571-7171); Finale (Coda Music Software, 1401 E. 79th St., Bloomington, MN 55420, [612] 854-1288); High Score (Advanced Music Notation Systems, 31 Colonial Dr., Littleton, MA 01460, [617] 486-0132); Music Publisher (Graphic Notes, Inc., 2-1645 East Cliff Dr., Suite 29, Santa Cruz, CA 95062, [408] 476-0147); MusicPublisher (Saherazam, Box 26731, Milwaukee, WI 53226, [414] 442-7503); and Musikrafters (Musikrafters Music Services, Box 14124, Louisville, KY 40214, [502] 361-4587).

There are also a number of public domain and shareware programs that are available either free or for a minimal charge from computer user groups or sales groups like Educomp. For example, Manual.Fd is a PostScript program which, when sent to the LaserWriter, disables the "Manual feed instructions" that print out every time you wish to hand feed paper into the printer. There's also LaserKey, which uses the Command-Shift-4 key sequence to print the screen image from the LaserWriter. It allows image smoothing and multiple copies. The programs Disable Page and Enable Page

allow you to turn off and on the test page that prints each time you turn on the printer. Laser Stop Print also disables the test page.

MS-DOS Software

Why use a LaserWriter when you have a PC? That's easy: you get lots of great professional typefaces, you get the ability to take the same document directly to a typesetter for extremely high quality output, and it's not hard to do.

And why have an Apple LaserWriter doing your printing rather than IBM's PostScript printer? Before you buy "Big Blue's" printer, read about it in Chapter Fourteen.

Any PC application running under Microsoft Windows or Digital Research's GEM environment will, of course, be able to use the LaserWriters. At least, their designers have tried to build in PostScript support. An improved Windows PostScript driver is available from Micrografx (1820 N. Greenville Ave., Richardson, TX 75081, [214] 234-1769 or [800] 272-DRAW), and is included with all Micrografx software. It is also sold separately and works with any Windows application. Rotated text, EPS file creation, faster imaging, image scaling, and higher quality line styles are features of this improved driver.

In order to improve the screen image and have it closer to what will print from the LaserWriter or other PostScript printer, consider using Renaissance GRX's Legacy II Switching Adapter and its Rendition I Graphics controller. It images PostScript typefaces accurately on the PC's monitor while running Windows applications.

In addition, some MS-DOS software comes with specific LaserWriter or PostScript printer drivers. Microsoft's Word word processing program has been a leader in using the rich formatting environment available with a PostScript printer such as the Apple LaserWriters. Obtaining the IBM Extended Character Set through PostScript printers is possible with Extend! (Design Systems, One Kendall Square, Suite 2200, Cambridge, MA 0139, [617] 577-8039).

There are several programs to convert Lotus 1-2-3 files so they print on an AppleTalk-linked LaserWriter. A few are mentioned later in this chapter under the "Graphics Software" section. There's also LaserLink (Diversified I/O Inc., 1008 Stewart Dr., Sunnyvale, CA 94086 [408] 730-2171) which installs as a pop-up menu in 1-2-3 so you can automatically print from within the application. You can change fonts, adjust the size of the printed spreadsheet, or print upright or sideways. LaserLink also works with most other PC applications.

What if your favorite program doesn't work with PC applications? Well, you're still in the running with ESIM (Niche Marketing, 7198 Camino Colegio, Rohnert Park, CA 94928 [707] 765-7342), a software translator that converts

Epson printer control codes into PostScript. Thus, if your software will print on an Epson printer, you can print on the LaserWriter, too.

Tangent's LaserScript software takes any Epson output file and converts it into PostScript for beautiful printing from the LaserWriter. LaserUtilities (S. Anthony Studios, 889 DeHaro St., San Francisco, CA 94107, [415] 826-6193) takes standard text files and allows PostScript formatting and commands to be added. MS-DOS fonts are also available.

The following pages provide information about some of the lesser known programs that you will want to investigate when you hook your PC into LaserWriter power.

Text Processing

There are some very specialized word processing programs available for the IBM personal computers; many are described below. You will not encounter many of these technical specialized word processors on the Macintosh side of the fence, and there's a good reason. With the Mac's excellent support of desk accessories and its ready acceptance of imported text and graphics formats, specialized word processors are designed by the *user*, not by software developer firms. This may sound strange, but if you couple Microsoft Word or WordPerfect's WordPerfect for the Mac with one or two desk accessory add-ons, you've got some very highly specialized document processing capabilities, and you haven't lost the ease of use the Mac is famous for.

For example, combining Word with Chemintosh DA by SoftShell, you have a very highly powered, yet simple, chemistry documentation system that is easy to use. When stepping out of the Macintosh environment into the DOS world, you must go to a highly specialized program like ChemText or T^3 described below. Even then you lose some of the add-on capability and ease of the Macintosh system. The same is true of math and physics documentation. The Mac is popular for communication among scientists because the specialization can be built in modularly. Nevertheless, don't let not having a Macintosh keep you from having the great LaserWriter look to your documents. Try one of the components mentioned in the following paragraphs.

Laser-Set (Laser Technologies, Int'l., 15403 E. Alondra Blvd., La Mirada, CA 90638, [714] 739-2478) is a text formatter which includes a preview mode, automatic kerning, and twelve downloadable fonts in sizes from 8 to 30 points.

ChemText (Molecular Design Ltd., 2132 Farallon Dr., San Leandro, CA 94577, [415] 895-1313) is a text and graphics processor that creates complex chemical structural formulas and integrates them into text documents. It does on the IBM-PC what a combination of Microsoft Word and Chemintosh DA does for the Macintosh.

Hockney's Egg (Perigrine Falcon, Box 2023, Mill Valley, CA 94942, [415] 331-8131) is a text processor, specifically designed for mathematics, which has the capability to create complex math equations.

Manuscript (Lotus Development Corp., 55 Cambridge Parkway, Cambridge, MA 02142, [617] 577-8500) is a technical word processor that utilizes the LaserWriter's PostScript function to output very highly controlled and formatted documents. Manuscript allows twenty fonts per document and has a font manager to download fonts to the LaserWriter. Importing TIFF and PostScript files is also supported.

Another scientific word processor that takes advantage of the LaserWriter's excellent quality is T^3 Scientific Word Processing System (TCI Software Research Inc., 1190-B Foster Rd., Las Cruces, NM 88001, [505] 522-4600). Like ChemText, it has the capability to design complex chemical structures in addition to mathematical equations.

Microsoft Word (Microsoft Corp., 16011 N.E. 36th Way, Box 97017, Redmond, WA 98073-9717, [206] 882-8080) is a popular word processor with a high degree of built-in functionality and the ability to use many of the LaserWriter's features. You may have envied Macintosh users of Word when they pull down a Page Preview menu to see an on-screen representation of how the printed document will look when it's printed. Well, Microsoft has an add-on program for their Windows environment called PageView that does it. You can preview pages and adjust page margins before printing. It also shows page breaks, columns, fonts, and paragraph formatting, and allows you to import graphics to your Word document using a clipboard feature. Version 4.0 allows portrait and landscape printing and offers a greater selection of typefaces and sizes.

Microsoft Word users should take a look at LWPlus (The Laser Edge, 360 17th St., Oakland, CA 94612, [415] 835-1581), a specialized LaserWriter driver that adds much more functionality to the program. For example, you get the full selection of LaserWriter typefaces in a much wider range of sizes. It also has better support of foreign characters (you actually see them on the screen, too) and furnishes you line and box drawing tools that work on PostScript printers. PostScript programs can also be incorporated to provide special effects. If you're using Word-IBM with a PostScript printer, this program will put you in control.

If you're using Word with the original LaserWriter or LaserWriter Plus, REVERSE (Niche Marketing, 7198 Camino Colegio, Rohnert Park, CA 94928, [707] 765-7342) prints documents in proper collated order so you won't have to restack them.

Other high quality word processors for MS-DOS that take advantage of the LaserWriter are WordPerfect (WordPerfect Corp., 266 W. Center St., Orem, UT 84057, [801] 227-4000), FinalWord II (Mark of the Unicorn Inc., 222 Third

St., Cambridge, MA 02142, [617] 576-2760), WordStar Classic, WordStar 2000 and 2000 Plus (MicroPro International, 33 San Pablo Road, San Rafael, CA 94903, [415] 499-1200), Leading Edge Word Processor (Leading Edge Software Products, 21 Highland Circle, Needham, MA 02194, [617] 449-4655), NewWord (Newstar Software Inc., 1601 Oak Park Blvd., Pleasant Hill, CA 94523, [415] 932-2278), SAMNA Word III (SAMNA Corp., 2700 NE Expressway, Suite C700, Atlanta, GA 30345, [404] 321-5006), Spellbinder (Lexisoft Inc., Box 1950, Davis, CA 95617, [916] 758-3630), and Volkswriter (Lifetree Software Inc., 411 Pacific St., Monterey, CA 93940, [408] 373-4718).

The popular mainframe word processing program, MASS-11 (Microsystems Engineering Corp., 2400 W. Hassel Road, Suite 400, Hoffman Estates, IL 60195, [312] 882-0111), is available in an MS-DOS version that can access up to 43 PostScript typefaces for an unlimited range of sizes and can import Lotus 1-2-3 graphics for inclusion into printed documents. There is also a chemical structure symbol library set available.

Other specialized word processors that print from the LaserWriters are WordMarc Author and WordMarc Composer (Marc Software Int'l., 260 Sheridan Ave., Suite 200, Palo Alto, CA 94306, [415] 326-1971) and The Professional Writer's Package (Emerging Technology Consultants Inc., 4760 Walnut St., Boulder, CO 80302, [303] 447-9495 or [800] 782-4896).

Q&A Write (Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014, [408] 253-9600) is a middle-of-the-road word processor designed for executives and managers. It will import Lotus 1-2-3 spreadsheets and graphics, and can handle up to nine fonts in a single document.

Graphics Software

Several popular PC graphics programs take advantage of the LaserWriter's PostScript abilities. GEM Draw and GEM Paint (Digital Research, Inc., 60 Garden Ct., Monterey, CA 93942, [408] 649-3896), PC Paintbrush Plus, PC Paintbrush for Windows, and Publisher's Paintbrush (Zsoft Corp., 450 Franklin Rd., Suite 100, Marietta, GA 30067, [404] 428-0008), and Windows Draw (Micrografx Inc., 1820 N. Greenville Ave., Richardson, TX 75081, [214] 234-1769 or [800] 272-DRAW) are among the more popular graphics programs.

You can also convert MacPaint images into PCPaintbrush or Microsoft Windows files using HiJaak (InSet Systems Inc., 12 Mill Rd., Danbury, CT 06811, [800] 828-8088), which converts file formats among the Macintosh, Amiga and MS-DOS worlds. With HiJack, Macintosh clip art files in MacPaint format can be batch processed into MS-DOS-compatible format, and AutoCAD files can be converted into PCPaintbrush form for high resolution editing. It can also convert TIFF scanner files into PostScript format.

Several other graphics file conversion programs are available. The Graphics Link from PC Quik-Art and CVT from Bright Ideas Inc. (52 Exeter

St., Portland, ME 04102, [207] 775-1330) are two examples. The former translates among PC Paintbrush, Microsoft Windows Paint, Dr. Halo, PC Paint, GEM Paint, EGA Paint, and MacPaint on the Macintosh. The latter converts among TIFF, PC Paint, and GEM formats. A color version that includes links to Macintosh files is being readied for release.

PSPlot (Legend Communications, 54 Rosedale Ave., Brampton, Ontario L6X 1K1, [416] 457-6298) generates encapsulated PostScript (EPSF) files from MS-DOS and mainframe CAD programs such as AutoCAD and Generic CAD so you can print drawings using the LaserWriter. You can also use it to import the CAD files into page layout software with much better image control than is possible by simply using the page layout program. PSPlot is fast, too. The well-known AutoCAD nozzle is plotted in less than a minute on the LaserWriter. Up to eight pens may be configured with different line styles and widths to simulate colors, and drawings can be rotated and scaled. If your software uses the Hewlett-Packard Graphics Language (HP-GL) file protocols, PSPlot will convert files into PostScript and converts contained text to the Courier font. You can then search the PostScript file and replace the Courier typeface with any other you wish.

Another utility that allows plotting on the LaserWriter is PS Plot (Tangent Technologies, 5720 Peachtree Pkwy., Suite 100, Norcross, GA 30092, [404] 662-0366), which converts Houston Instrument's DM/PL plotter commands into PostScript.

If you're using AutoCAD and the LaserWriter, you can gain control over AutocAD's rather mundane text fonts with AutoScript from Preco Industries (9501 Dice Lane, Lenexa, KS 66215, [913] 541-0066). With AutoScript, you can use any of the LaserWriter's fonts and then convert the finished AutoCAD file into Encapsulated PostScript Format (EPSF), which can then be placed in Ventura Publisher or PageMaker, complete with the high quality PostScript fonts.

Many CAD programs have PostScript drivers included. Any of these may be used with your LaserWriter. Note, however, that the degree of PostScript implementation varies depending on the program. VersaCAD (VersaCAD Corp., 2124 Main St., Huntington Beach, CA 92648, [714] 847-9960) is generally considered to have the most complete PostScript output. Three typefaces (Times, Helvetica, and Courier) are supported, as are various line widths. AutoCAD (Autodesk Inc., 2320 Marinship Way, Sausalito, CA 94965, [415] 332-2344), on the other hand, does not support PostScript typefaces and is restricted to a single line width.

If you want to print Lotus 1-2-3 graphics on your LaserWriter, 123Laser (C. Carlson, 140 University Ave., Suite 156, Palo Alto, CA 94301) or LaserScript Plus, PSPrint, and WinPrint (Tangent Technologies, 5720 Peachtree Pkwy., Suite 100, Norcross, GA 30092, [404] 662-0366) will do the file translation to PostScript.

Tangent's LaserScript software converts Lotus 1-2-3 spreadsheet files and WordStar and MultiMate word processing files into PostScript.

A screen image printing program, PrtSc.ps (S. Anthony Studios, 889 De-Haro St., San Francisco, CA 94107, [415] 826-6193), prints to a PostScript printer from the PrtSc key.

There are quite a number of drawing programs that are designed to create visual presentations using the LaserWriter. Designer (Micrografx Inc., 1820 N. Greenville Ave., Richardson, TX 75081, [214] 234-1769 or [800] 272-DRAW), for example, is a full color Windows-compatible graphic art and technical illustration program and is compatible with the other Micrografx programs, Windows Draw and Windows Graph. It restricts colors to layers so that color separations may be printed out. It comes with Convert, a file translator that converts AutoCAD files into Designer-compatible files.

Graph Station (Software Clearing House Inc., Box 38206, Cincinnati, OH 45238-9985, [513] 451-6742) is a PC-based presentation graphics program that can include font sizes from 6 to 72 points and accept Lotus 1-2-3 and Symphony files for further enhancing.

35mm Express (BPS, 143 Binney St., Cambridge, MA 02142, [617] 491-3377) converts simple Lotus 1-2-3 and Symphony charts into a form to be enhanced into presentation quality and formed into color separated layers. High quality text and clip art symbols can be added.

Artwork Environment (West End Film Inc., 1825 Q St., NW, Washington, DC 20009, [202] 232-7733) is a family of graphic software packages designed to create graphics of presentation quality using a PC. For example, slides of extremely high clarity can be created from film cameras having 4,000 line resolution after being proofed on a LaserWriter. Input of graphics from AutoCAD, 1-2-3, and Hewlett-Packard Graphics (HPGL) plotter files makes the editing and enhancing process easier.

Other presentation graphics programs for the PC and LaserWriter are Chart (Microsoft Corp., 16011 NE 36th Way, Redmond, WA 98073, [206] 882-8080), Freelance Plus (Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, [617] 577-1100), ImageStation and RIO (AT&T Graphics Software Labs, 10291 N. Meridian, Suite 275, Indianapolis, IN 46290, [317] 844-4364), Autumn and Mirage (Zenographics, 19752 MacArthur Blvd., Suite 250, Irvine, CA 92715, [714] 851-6352), Harvard Presentation Graphics (Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94043, [415] 962-8910), GEM Graph and GEM Word Chart (Digital Research Inc., 60 Garden Ct., Monterey, CA 93942, [408] 649-3896), Boardroom Graphics (Analytical Software, 10939 McCree Rd., Dallas, TX 75238, [214] 340-2564), PC-Slide (Management Graphics Inc., 1450 Lodestar Rd., Downsview, Ontario M3J 3C1), and Chart-Master, Diagram-Master, Map-Master, and Sign-Master (Ashton-Tate, 25 Sylvan Rd., Westport, CT 06880, [203] 222-1974).

The popular mainframe illustration program, MASS-11 Draw (Microsystems Engineering Corp., 2400 W. Hassel Road, Suite 400, Hoffman Estates, IL 60195, [312] 882-0111) is available in an MS-DOS version that can access the LaserWriter's typefaces and sizes as well as import Lotus 1-2-3 graphics for enhancement.

Images from video cameras, VCRs, and camcorders can be captured by your PC and an image processing board using Aldus's SnapShot software, which freezes the image which can then be placed in a PageMaker layout and printed from the LaserWriter. One can retouch and edit the image and add special effects.

Page Layout Software

Though page layout got its start on the Macintosh, there's plenty of action on the PC side of the desk. To take full advantage of the application, you need software that taps the power of PostScript so that documents can be printed on a LaserWriter as a design proof, and then a final master can be run on a Linotronic at high resolution.

You have to be quite wary when you compare page layout and design software for the PC. You are often shown a wonderful list of features—beautiful printouts, large, fancy headlines, and super graphics—even though the sales brochure hardly ever mentions the hardware you need to match the stunning results that have been shown you. The specifications often mention only the minimum hardware requirements.

Beware and be forewarned; ask a lot of questions. Many programs brag about fonts from 2 points to 2,000 points and then mention that all you need to run "Whoopy-Page" is a 256K PC with a single floppy drive and an Okidata LaserLine6 laser printer. Although this may be true, don't expect scalable font sizes. Many of the highly touted bells and whistles come *only* when you have a PostScript laser printer hooked up.

In addition, don't be fooled when someone tries to appeal to the old PC mentality by implying that a mouse is a kid's toy. For graphics and desktop publishing, you need a freehand cursor control such as a mouse or a trackball. It may not be the Lotus 1-2-3 power-user's device, but it is the power-user desktop publisher's device.

There's a wide variety of page layout programs to choose from. The following paragraphs contain a sampling.

Currently, the two most popular desktop publishing packages for the PC are Ventura Publisher (Xerox Corp., 101 Continental Blvd., El Segundo, CA 90245, [800] 822-8221) and PageMaker (Aldus Corp., 411 First Ave., Suite 200, Seattle, WA 98104, [206] 622-5500). Either of these programs should satisfy the typical desktop publishing needs for the average business user. Using a

PostScript printer such as an Apple LaserWriter adds great power to desktop publishing on the PC. For example, Ventura Publisher accesses only Font F on the H-P LaserJet printers—hardly a rich publishing environment.

You can add to the already great possibilities of the Ventura Publisher/LaserWriter combination with Newfont from Corel Systems Corp. (1600 Carling Blvd., Ottawa, Ontario, K1A 7M4 Canada, [613] 728-8200). This add-on rotates, outlines, stretches, and tilts PostScript text fonts for special effects. Corel also has the Corel Ventura Utilities package containing seven useful additions for Ventura users. Among them is PSPRINT, which can be used for printing standard text files on the LaserWriter. It also gives control over typeface and size selection. Another utility, TIMEOUT, modifies the standard DOS communication parameters to allow large or complex PostScript files to be printed using DTR (data terminal ready) protocols from your PC's serial port.

Also making a bid for PC users is GEM Desktop Publisher (Digital Research Inc., 60 Garden Ct., Monterey, CA 93942, [408] 649-3896). There are a few things to look into before you invest, however. Although the program supports PostScript laser printers like the Apple LaserWriter, the original release didn't allow printing on the Linotronics. It also restricted you to Times and Helvetica, and even this was only a partial access to the full character set. Special characters, such as the Option characters, were not available. This means that bullets, em dashes, and curly quotes were not available. Newer versions of GEM, particularly GEM/3 and higher versions, offer improved support for PostScript printers. Coupled with the complete set of screen fonts, GEM/3 accesses all the fonts resident in the LaserWriter II NT.

There are other desktop publishing programs, to be sure, and some are designed for the simple formatting of long documents such as books, whereas others are more suited to creating advertisements and newspapers. The package of ULTIMATE Editor, Desktop Typographer, Proofer, Page Previewer and System Manager software (Composition Technologies Inc., 505 Dorchester West, Suite 1000, Montreal, Que., Canada, H2Z 1A8, [514] 875-7586) and Intrepid II (Compugraphic Corp., 200 Ballardville St., Wilmington, MA 01887, [617] 658-5600) are examples of the latter.

Four of the better, low-end PC desktop publishing programs that support PostScript printers such as the Apple LaserWriters are Publish-It (Timeworks, 444 Lake Cook Rd., Deerfield, IL 60015, [312] 948-9200), Laser-Set (Laser Technologies International, 15403 E. Alondra Blvd., La Mirada, CA 90638, [714] 739-2478), Byline (Ashton-Tate Publishing Co., 20101 Hamilton Ave., Torrance, CA 90502-1319, [213] 329-8000), and PFS First Publisher (Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94039, [415] 962-8910). These inexpensive programs should satisfy many simple, business-related publishing tasks.

LaserMaker (LaserMaker Inc., 1117 Eleventh St., Suite 105, Manhattan Beach, CA 90266, [213] 379-2299) is a layout and typesetting package of medium cost that runs on the IBM PCs and outputs to PostScript devices such as the LaserWriter.

There's also FrontPage and DO-IT (Studio Software, 17862-C Fitch, Irvine, CA 94043, [714] 474-0131), SuperPage (Bestinfo Inc., 1400 N. Providence Rd. #117, Media, PA 19063, [215] 891-6500), Desktop Page Composition System (Vision Research, 1590 Old Oakland Rd., Suite B-112, San Jose, CA95131, [408] 298-8700), MECCA III (Amgraf Inc., 1501 Oak St., Kansas City, MO 64108, [816] 474-4797), Page-it (Duncan Graphics, Box 1597, Glen Burne, MD 21061, [301] 766-1767), PagePlanner Pro (New American PagePlanner, One Maple St., E. Rutherford, NJ 07073, [201] 933-4868), and Spellbinder Desktop Publisher (Lexisoft Inc., Box 1950, Davis, CA 95617, [916] 758-3630).

Other publishing programs include ScenicWriter (ScenicSoft Inc., 12314 Scenic Dr., Edmonds, WA 98020, [206] 776-7760), Signature (Varityper, 11 Mt. Pleasant Ave., East Hanover, NJ 07936, [201] 887-8000), PAGEWORK (West End Film, 1825 Q St. NW, Washington, DC 20009, [202] 232-7733), PagePerfect (IMSI, 1299 Fourth St., San Rafael, CA 94901, [415] 454-7101), PageWriter (The 'Puter Group, 1717 West Beltline Hwy., Madison, WI 53713, [608] 273-1803), and Flexicon (Emerging Technology Consultants Inc., 4760 Walnut St., Boulder, CO 80302, [303] 447-9495 or [800] 782-4896).

PC Publisher Kit (Imagen Corp., 2650 San Tomas Expressway, Santa Clara, CA 95052, [408] 986-9400) includes a printer enhancement board that supports PostScript printers.

The PC version of Microsoft Word is, of course, a richly featured program with a great deal of page formatting capability. You can enhance Word's page layout features with Cybertype (Cyber Research Inc., 5 Science Park Center, New Haven, CT 06536, [203] 786-5151), which provides direct access to PostScript commands to let the user enlarge pages to 11 by 17 inches and print "tiled" sections complete with registration marks. Another add-on program, Cybermerge, merges graphics into Microsoft Word from AT&T's Targa board or from programs supporting plotter output. With this capability, halftones of 160 dots per inch with 256 gray levels can be generated from high resolution typesetters.

We've already mentioned TeXtures for the Macintosh. There's a similar version of TeX for the PC, MicroTeX (Addison-Wesley Publishing Co., One Jacob Way, Reading, MA 01867, [617] 944-6795), which interchanges files with the Mac version. Another PostScript-compatible version of TeX for the PC is PC TeX (Personal TeX Inc., 20 Sunnyside, Suite H, Mill Valley, CA 94941, [415] 388-8853).

A utility to install PostScript fonts in a MS-DOS TeX program and to use the PostScript fonts with the standard TeX support for kerning and ligatures is

provided by AFTOTF (Western Wares, Box C, Norwood, CO 81423, [303] 327-4898).

Miscellaneous PC Software

Two music composition programs that take advantage of the LaserWriter's excellent printed output, Score (Passport Designs Inc., 625 Miramonte St., Half Moon Bay, CA 94019, [415] 726-0280) and Personal Composer (Personal Composer, 16929 Inglewood Rd NE, Suite C305, Bothell, WA 98011, [206] 488-8088) are worth mentioning. You'll want to have Adobe's Sonata font for these programs. An MS-DOS version of Finale (Coda Music Software, 1401 E. 79th St., Bloomington, MN 55420, [612] 854-1288) is also being developed.

Software for the Apple II

The Apple II can do beautiful things when coupled with the LaserWriter. If you are interested in this combination, be sure to find out all there is from Synergetics (Box 809B, Thatcher, AZ 85552, [602] 428-4073), who has quite a few guides and utilities for putting Apple II text and graphics into PostScript for printing on the LaserWriter. Its AppleWriter/LaserWriter Utilities Package is composed of five disks full of goodies.

Also helpful are LaserDumps, a program for printing high resolution screen images from a LaserWriter, and LaserUtilities, a program for producing PostScript-compatible files from DOS 3.3 or ProDOS text documents (S. Anthony Studios, 889 DeHaro St., San Fransisco, CA 94107, [415] 826-6193). They also have fonts for the Apple II.

Graphics Software

For the Apple II, look into Drawing Table (Broderbund Software Inc., 17 Paul Dr., San Rafael, CA 94903, [415] 479-1700) or TopDraw (StyleWare Inc., 5250 Gulfton, Suite 2E, Houston, TX 77081, [713] 668-1360).

Page Layout Software

Although most people will readily admit that the best computer platform for desktop publishing is the Macintosh, particularly the Mac II, there are a few programs for the Apple IIgs. Among them are NewsSet/Adnet (Concept Publishing Systems, 126 Monroe St., Beaver Dam, WI 53916, [414] 887-3731), Springboard Publisher (Springboard Software Inc., 7808 Creekridge Circle, Minneapolis, MN 55435, [612] 944-3915), NewsMaker (Megahaus Corp., 6215 Ferris Sq., San Diego, CA 92121, [619] 450-1230); Publish-It (Timeworks, 444 Lake Cook Rd., Deerfield, IL 60015, [312] 948-9200) and Quark Xtra (Quark Inc., 2525 W. Evans, Suite 220, Denver, CO 80218, [303] 934-2211).

Miscellaneous Apple II Software

A music transcription program, Finale (Coda Music Software, 1401 E. 79th St., Bloomington, MN 55420, [612] 854-1288), is being developed to take MIDI-linked keyboard input and print finished sheet music from the LaserWriter.

Software for the Atari ST

PostScript printers such as the LaserWriters are primarily business printers. Not too many people have them around the house. That means that for most of the home market computers, there isn't much in the way of PostScript-compatible software. (Of course, the lines here are blurred. The Atari ST and Amiga computers certainly have the digital capability to be powerful business computers, but, realistically, they just haven't significantly penetrated the business market, nor have many software publishers written many highly powered business programs for them.) The following paragraphs reflect what is available for the ST at the time of publication.

Publishing Partner Professional (Soft Logik Corp., 11137 S. Towne Square, Suite C, St. Louis, MO 63123, [314] 894-8608) is a desktop publishing program for the ST that combines three functions—word processing, page layout and forms creation—into one package. It features automatic text flow around graphics, search and replace of type specs, kerning, and text and graphics rotation in one-degree increments.

Another desktop publishing program for the ST, Fleet Street Publisher, is being developed by Mirrorsoft Ltd. (74 Worship St., London EC2A2EN, United Kingdom).

A fairly full-featured desktop publishing package, Publish-It (Timeworks, 444 Lake Cook Rd., Deerfield, IL 60015, [312] 948-9200), offers automatic text flow between columns, hyphenation, built-in text processing and editing, text and graphics importing, and a set of drawing tools for adding lines, boxes, circles, etc.

Graphic Artist (Progressive Computer Applications, 2002 McAuliffe Dr., Rockville, MD 20851, [301] 340-8398) is a PostScript-compatible, structured drawing program for the Atari ST.

An Atari version of Finale (Coda Music Software, 1401 E. 79th St., Bloomington, MN 55420, [612] 854-1288) is also being developed to record musical input and create PostScript files for printing music notation.

Software for the Commodore Amiga

Aegis Draw Plus (Aegis Development Inc., 2210 Wilshire # 227, Santa Monica, CA 90403, [213] 392-9972) is a PostScript-compatible CAD drawing program for the Amiga, and Professional Page (Gold Disk Inc., Box 789, Streetsville, ONT L5M 2C2, Canada, [416] 828-0913) and Publisher 1000 (Brown-Wagh Publishing, 16795 Lark Ave., Suite 210, Los Gatos, CA 95030, [408] 395-3838) are desktop publishing programs capable of printing on a LaserWriter.

LaserUtilities (S. Anthony Studios, 889 DeHaro St., San Fransisco, CA 94107, [415] 826-6193) produces PostScript-compatible files from AmigaDOS files. The company also has fonts and a screen dump printing utility for the Amiga. Its LaserUp! Print, Plot, and Paint programs transform graphic images, includ-

ing color Digi-View images, into digital halftones for printing on a LaserWriter or Linotronic.

Converting graphic images into (or out of) Amiga format can be done with HiJaak (InSet Systems Inc., 12 Mill Rd., Danbury, CT 06811, [800] 828-8088), which converts file formats among the Macintosh, Amiga, and MS-DOS worlds. It can also convert TIFF scanner files into Amiga format.

Minis, Mainframes, and Miscellaneous Systems

The Macintosh is an excellent choice as a terminal or front end for minis and mainframes because there are a wide variety of connectivity solutions, and the Mac has such fine text and graphics handling ability. Similarly, the LaserWriters and other PostScript printers offer excellent printing and proofing stations for minicomputers and mainframes.

A wide variety of software taps the LaserWriter's superb graphics and text output, and most of the professional publishing packages offer support for the LaserWriters. There is growing support for PostScript output from minicomputer and mainframe computer applications; the list grows daily.

Word Processing

The Professional Writer's Package (Emerging Technology Consultants Inc., 4760 Walnut St., Boulder, CO 80302, [303] 447-9495 or [800] 782-4896) is a very highly powered document processor for single-user XENIX systems and for multi-user UNIX and VMS systems such as the Sun, AT&T, NCR, Masscomp, and Digital microVAX and VAX computers. It is specifically designed to work with PostScript output devices.

The popular VAX/VMS and MicroVAX word processing program, MASS-11, and its graphics-drawing cousin, MASS-11 Draw (Microsystems Engineering Corp., 2400 W. Hassel Road, Suite 400, Hoffman Estates, IL 60195, [312] 882-0111), are available with PostScript output.

Word 11 (Data Processing Design Inc., 1400 No. Brasher St., Anaheim, CA 92807, [714] 970-1515), WordMarc Author, and WordMarc Composer (Marc Software Inc., 260 Sheridan Ave., Suite 200, Palo Alto, CA 94306, [415] 326-1971) are other word processing packages that will run on VMS, UNIX, or Prime systems.

Penta Editorial (Penta Systems Int'l., 1511 Guilford Ave., Baltimore, MD 21202, [301] 244-0050) and SuperVUE (ProVUE Development, 222 22nd St., Huntington Beach, CA 92648, [714] 969-2341) run on the Data Genral AOSVS and Alpha Micro 100L, respectively.

Graphics Programs

The Danford GRID Drawing Sytem, a two-dimensional graphic arts drawing package for the Apollo computer, and The Danford Presentation Graphics Design System (Danford Corp., 350 West Fifth St., San Diego, CA 90731, [213]

514-9334) are designed to print from the LaserWriters using Danford's PSPrint utility.

The Pansophic Starburst (Pansophic Systems Inc., 709 Enterprise Dr., Oak Brook, IL 60521, [800] 323-7335) is an integrated system for creating text, chart, and art graphics to generate high resolution 35mm slides, 4 by 5-inch or 8 by 10-inch hard copies, and transparencies in-house. The LaserWriter may be used to produce professional looking overheads and for proofing materials prior to using a high quality color printer or film recorder. Pansophic also supplies general graphics programs that run on the VMS, UNIX, and MVS/TSO operating environments.

Other graphics programs available for the UNIX and VMS operating environments are PicSure (Precision Visuals Inc., 6260 Lookout Rd., Boulder, CO 80301, [303] 530-9000), Tech Illustrator and Graphic Designer (Auto-trol Technology, 12500 N. Washington St., Denver, CO 80233, [303] 452-4919), and Visual:GKS, Visual:ProChart, and C-Chart (Visual Engineering, 2680 North First St., Suite 200, San Jose, CA 95134, [408] 945) 905).

There are also a great many CAD programs that support PostScript printers like the LaserWriters, but if your package doesn't have a PostScript driver, a conversion utility has been developed by Kevin Keane (1520 York Ave., New York, NY 10028) to convert Hewlett-Packard Graphics Language (HPGL) print and plot commands into PostScript format for the VM/CMS and Prime OS operating systems.

Electronic Publishing

There is a wide variety of multi-user publishing packages that output PostScript files which can be readily proofed on the LaserWriters. Indeed, the LaserWriter II NTX is an ideal proofing printer which, with its large font storage capability, mimics the features of a Linotronic.

The Publisher (ArborText Inc., 416 Fourth St., Ann Arbor, MI 48107, [313] 996-3566), for example, is a WYSIWYG, interactive electronic publishing software package for the Sun workstation that includes paint and draw modes for graphics and uses PostScript output devices such as the LaserWriters.

There are other software packages for the Sun workstation that support PostScript printers, including Frame Maker 1.1 (Frame Technology, 2911 Zanker Rd., San Jose, CA 95134-2125, [408] 433-3311) and Interleaf Publisher (Interleaf Inc., 10 Canal Park, Cambridge, MA 02141, [617] 577-9800). Both have versions for the Mac II also.

UNIX packages include Alis (APPLiX Inc., 112 Turnpike Rd., Westboro, MA 01581, [617] 870-0300), CAPS (Compugraphic Corp., 200 Ballardville Rd., Wilmington, MA 01887, [617] 658-5600), Composer (Intran, 5601 Smetana Dr., Minnetonka, MN 55343, [612] 931-9170), Crystal Publishing System (Syntactics Corp., 3333 Bowers Ave., Suite 145, Santa Clara, CA 95054, [408] 727-

6400), Electronic Publishing System (Intergraph, One Madison Park, Huntsville, AL 35807, [205] 772-2000), Frame Maker (Frame Technology Corp., 2240 Lundy Ave., San Jose, CA 95131, [408] 433-3311), Integrated Workstation-IWS (NBI Inc., 3450 Mitchell Lane, Boulder, CO 80301, [303] 444-5710), Intelligent Documentation (CIMLINC Inc., 700 Nicholas Blvd., Elk Grove, IL 60007, [312] 228-7300), Live Image Publishing System (Texet Corp., 37 Broadway, Arlington, MA 02174, [617] 641-2900), OmniPage (OmniPage Corp., 1000 Pittsford-Victor Rd., Rochester, NY 14534, [716] 385-8888), Technical Publishing Software and University Publishing Software (Interleaf, 10 Canal Park, Cambridge, MA 02141, [617] 577-9800), TyxSET (Tyx Corp., 11250 Roger Bacon Dr., Suite 16, Reston, VA 22090, [703] 471-0233), and Vision Network System (Bedford Computer Corp., Tirrell Hill Rd., Bedford, NH 03102, [603] 668-3400).

There are two TeX programs that are PostScript-compatible. One version from ArborText Inc. (416 Fourth St., Ann Arbor, MI 48107, [313] 996-3566) runs on INIX, VMS, MVS, and several other operating systems. TeX under VMS (Kellerman & Smith, 534 SW 3rd Ave., Portland, OR 97204, [503] 222-4234) runs on the VMS operating system.

Other VMS programs include Electronic Publishing System (Intergraph, One Madison Park, Huntsville, AL 35807, [205] 772-2000), Technical Publishing Environment (Datalogics Inc., 325 W. Huron St., Chicago, IL 60610, [312] 266-4444), and TyxSET (Tyx Corp., 11250 Roger Bacon Dr., Suite 16, Reston, VA 22090, [703] 471-0233).

PostScript is the "glue" that binds all these disparate computer applications together, and it's a glue that adds quality and transportability. Your LaserWriter has this capability already built in. It may be the last printer you'll ever have to buy.

CHAPTER **ELEVEN**

A PostScript Primer

Laser printers are page printers, which makes them different from many printers that produce the printed page one character, or one row of dots, at a time. Those are called *serial* printers, which has nothing to do with the fact that they use a serial interface. Serial printers, like the daisy wheel or dot matrix, can have either a serial or parallel interface. The term *serial* describes the printing technique. Serial printers print one thing after another until the page is finished. Each character or element is printed in a series.

Page printers such as the laser printers are different. They assemble the entire page's image before the printing takes place, which is a complicated procedure that takes quite a bit of computing power to do. That's why laser printers usually have powerful microprocessors.

The development of page printers and imagesetting typesetters calls for a great deal of control over the page's image, especially if we hope to exert control over the type and graphics we want to place on the page. This is the work of special software in the form of a computer language called a *page description language*, or PDL.

The Basics of PostScript, the Leading Page Description Language

If you're interested in using a computer for desktop publishing, yet haven't considered buying a PostScript laser printer like Apple's LaserWriter II NT, you could end up being very disappointed in the whole desktop publishing scene. PostScript is vital for computer publishing, which is why Apple, IBM, Digital Equipment, Linotronic, Compugraphic, Hewlett-Packard, Xerox, Wang, and others have given it their official endorsement.

So, just what is this thing called "PostScript," and what does it really mean? First, let's get the "PostScript is a computer language" business out of the way. Consider PostScript simply a help—a big help for desktop publishing. It is a computer language, but that's something we can leave to the hackers. We desktop publishers don't need to program in PostScript, but we need PostScript even though we may never see any PostScript programming.

PostScript is a helper. It makes things work just as the operating system software makes your computer work. You don't have to be a programmer to get the power from your computer's operating system, and the same thing is true of PostScript.

Briefly, PostScript is a set of rules about how items—text and graphics—are arranged on a page. It's a "page description language." It works with the

files you create on your computer to place each element precisely where you intend.

PostScript Is Not Tied Down

PostScript describes the page in flexible terms. No matter how good your printer is (from 300 dots per inch for most laser printers, all the way to the ultra-resolution of a Linotronic typesetter's 2,450 dots per inch), the same file is used to print it. This is important. Think about it for a minute. With PostScript, you don't have to create a new file or use a special conversion program to print on printing devices of different quality. Each PostScript printing device will print your PostScript file in that device's resolution. Who cares? You should. Perhaps laser printouts are good enough to serve as printing masters for everything you do. That's great, but the day may come when you want better quality for a certain piece. What then?

It's simple with PostScript: just print your file on a higher resolution PostScript device. Take your PostScript file directly to a typesetter, for example.

What if laser printers get better (and they will) in the future? With PostScript, you don't have to worry about remaining compatible with higher resolution technology as printers get better and better. Your file will print just fine on PostScript printers that engineers haven't even thought of yet. PostScript makes your files device-independent. It's like having a file that will print on *any* printer, past or future, as long as it's built to be PostScript-compatible. I know that if it's a PostScript printer, I can always use it.

This means that as printer technology changes, you can take advantage of increased performance without having to make any file changes, which is not generally the case with other printing technologies. For example, as 18- and 24-pin dot matrix printers have become available, software has had to be changed to include these new printing formats along with the traditional 9-pin technology.

With PostScript, you can print out files at 300 dots per inch on today's laser printers, and the same file will work with tomorow's 600 dot per inch laser or 450 dot per inch color ink jet printers. PostScript prints your file in the device's resolution no matter what that resolution is.

You can thus print out a copy on your 300 dot per inch laser printer for proofing and then get a high quality typeset master from a 2,450 dot per inch phototypesetter—all with the same file. This is a must for serious publishing.

You may think, "That's nice, but it's not worth a couple of thousand dollars; there's got to be more." There is. Much more.

Publishing Is Yours

What's this desktop publishing revolution all about? It involves nothing less than giving you complete control over the appearance of your work, and the ability to integrate high quality graphics with the same kind of text that you

would otherwise get only if you went to typesetting. You have professional publishing when you want it, and it's on your terms.

We desktop publishers have discovered typefaces—real, professional "typesetter" typefaces. We even talk like big-time publishers. "Set the headline in Helvetica 72 Bold, callouts in 18 italics, body in Times 14." A variety of typefaces and sizes provides the professional look that you want for your documents. Furthermore, with PostScript power behind you, you can scale typefaces to the exact size you need. PostScript allows an almost infinite variety of sizes to be created. You're not stuck with a particular set of type sizes as you are with non-PostScript printers.

There's More

Having PostScript is like having a genie that makes any size type you ask for. PostScript also provides a wealth of added possibilities, including halftoning, color, the rotation and skewing of typefaces, and filling typefaces with graphics of all kinds, to mention only a few.

Most of today's page layout software works best with a PostScript laser printer. With PostScript at the helm, a greater variety of better looking typefaces is available. In short, the chances are high that your software, no matter what variety, will offer more options when you set up and design your document for PostScript printing.

All these features represent only today's technology. With PostScript becoming the industry standard, future software versions and enhancements will use more and more of PostScript's rich assortment of publishing features. With a PostScript printer, you'll be ready.

"What about us IBM users?" you ask. Don't worry, the Apple LaserWriter II NT is the best, most cost-effective technology for PC desktop publishing. If the Apple name bothers you, you can always slap a sticker over it, but whatever you do, don't overlook the tremendous power of a PostScript laser printer. It's designed for publishing, while most others are best suited for word processing.

A page description language such as PostScript is your key to publishing power.

A Deeper Look at PostScript

PostScript is a very powerful language, and yet it's not all that difficult to learn. If you're interested in the inner workings of PostScript, Adobe has training aids available, and you will find it a wise investment to purchase the two books about PostScript from Addison-Wesley: *PostScript Language Reference Manual* and *PostScript Language Tutorial and Cookbook.*

If you really get into programming with PostScript, Addison-Wesley's book *PostScript Program Design* should be part of your library, too. *Understanding PostScript Programming* (Sybex Books, Alameda, CA) by David A.

Hozgang is another helpful book. A videotape introduction to PostScript is available from Synergetics, along with a number of other items related to PostScript. And don't worry about PostScript's being too complicated. Most people are capable of learning a few PostScript tricks of the trade. There are also "help-along" programs that we'll discuss later.

Similar to any other popular computer technology, PostScript now has its own magazine and bulletin board service. Contact *The PostScript Language Journal* (Box 5763, Parsippany, NJ 07054) for details. The PostScript bulletin board that you may want to check out is *PostScript BBS* (2504 Sycamore St., Bay City, TX 77414; voice line [409] 244-4075; data line [409] 244-4704). This one is run by the National Independent PostScript Support Board.

How PostScript Works

PostScript is a text-based language—you won't be using zeros and ones to instruct the LaserWriter. PostScript uses normal text sequences, and all you need to work in PostScript is a word processor that will save in "text only" or ASCII text and a way to get the file to the printer. We'll talk about that in a later section.

Since PostScript is a text-based language, it can be sent from one computer to another and is basically machine-independent. Consequently it is fairly bulky. PostScript descriptions take lots of memory, especially when bit-mapped graphics on a page are described.

Putting PostScript in Capsules

We've already mentioned a special kind of PostScript graphics file, encapsulated PostScript (EPS), and here's how it works.

Macintosh files have two parts: a data fork and a resource fork. When saving a drawing as EPS, the PostScript description is placed in the data fork of the file, while the QuickDraw version is retained in the resource fork. In this way, two separate representations of the graphic are kept.

Normally the graphic would be saved only in the Mac's QuickDraw form which, for printing on the LaserWriter or Linotronic, would have to be translated back into PostScript. The translation isn't always perfect, however. Remember, too, that PostScript can do some things that QuickDraw can't do.

EPS files thus consist of two parts. One contains all the PostScript data codes needed to describe the image to a printer such as the LaserWriter or Allied Linotronic; the other is a QuickDraw PICT image file that displays on the computer's monitor so that when you place an EPS file into a page layout program, for example, you'll actually see a close representation on the screen.

Many programs let you save in EPS format, notably Cricket Draw, Adobe's Illustrator, Aldus's FreeHand, and LaserWare's LaserPaint. EPS files are easily imported into certain page layout programs such as PageMaker, Quark's Xpress, and Scenicsoft's ScenicWriter for the IBM-PC.

Good Things in Large Packages

We've mentioned before that PostScript is a bulky way to describe things, but it can move between devices having different resolutions, which makes it worthwhile.

Here's a look at just how bulky PostScript files can be. Each file is the same graphic, a one-inch circle. You will see by examining the file sizes in Table 11.1 that PostScript gets big when bit-mapped files such as MacPaint and FullPaint are described, yet it is quite economical with object-oriented files. You can also see in Table 11.1 that EPSF files are quite large because they consist of two different ways of describing the object: one for the screen and one for the PostScript printer.

Saving Files as PostScript

Many programs allow you to save in a number of different formats. With MS-DOS software, however, you may not always have such a choice, in which case you can convert a wide range of MS-DOS graphic image file formats into PostScript with HiJaak from InSet Systems.

To save the PostScript format from Macintosh applications that don't normally have a "save in PostScript" function, you can save a document's PostScript code by clicking the OK button on the LaserWriter print menu and immediately pressing Command-f. This saves the PostScript code without the LaserPrep information. If you also want to include LaserPrep (which makes

Table 11.1 Graphic File Sizes

Software	*Type*	*File Format*	*File Size (in bytes)*
MacPaint	bit-mapped	MacPaint	3,072
MacPaint	bit-mapped	PostScript	15,246
FullPaint	bit-mapped	FullPaint	2,556
FullPaint	bit-mapped	PostScript	18,842
Super-Paint	bit-mapped	SuperPaint	2,608
Super-Paint	bit-mapped	PostScript	2,186
MacDraw	object-oriented	MacDraw	544
MacDraw	object-oriented	PICT	566
MacDraw	object-oriented	PostScript	431
SuperPaint	object-oriented	SuperPaint	1,956
SuperPaint	object-oriented	PICT	556
SuperPaint	object-oriented	PostScript	469
Cricket Draw	object-oriented	Cricket Draw	904
Cricket Draw	object-oriented	PICT	6,409
Cricket Draw	object-oriented	EPSF	20,692
Cricket Draw	object-oriented	PostScript	541

the resulting file somewhat larger), press Command-k. For PageMaker, Command-f saves the PostScript code along with AldusPrep. Use Command-Option-f to exclude AldusPrep from the file.

Instead of the expected "Looking for LaserWriter" message, you will see "Creating a PostScript™ File" on the Mac screen. You will then find a file on your startup disk named PostScript0, and if you open it with MacWrite or another word processor that can open text-only files, you will see all the PostScript code for that document. Go ahead and try it. It can be your first venture into the land of PostScript.

Here is a PostScript file describing a single page created in MacWrite that contains the text "Apple's LaserWriters are PostScript printers." The word LaserWriters is in Times bold and the word PostScript is Times italic. The rest of the sentence is in 12-point Times Plain .

Here's what you get:

```
%!PS-Adobe-2.0
%%Title: Untitled
%%Creator: MacWrite
%%CreationDate: Monday, January 25, 1988
%%Pages: (atend)
%%BoundingBox: ? ? ? ?
%%PageBoundingBox: 30 31 582 761
%%For:
%%IncludeProcSet: "(AppleDict md)" 65 0
%%EndComments
%%EndProlog
%%BeginDocumentSetup
md begin

T T -31 -30 761 582 100 72 72 1 F F F F T T psu
(; document: Untitled)jn
0 mf
od
%%EndDocumentSetup
%%Page: ? 1
```

```
op
0 -42 xl
1 1 pen
0 0 gm
(nc 0 0 730 510 6 rc)kp
9 10 gm
(nc 0 5 730 480 6 rc)kp
bu fc
{}mark T /Times-Roman /|______Times-Roman 0 rf
bn
0 gr
bu fc
{}mark T /Times-Bold /|______Times-Bold 0 rf
bn
0 gr
0 gr
bu fc
{}mark T /Times-Italic /|______Times-Italic 0 rf
bn
0 gr
1 setTxMode
0 fs
12 fz
bu fc
2 F /|______Times-Roman fnt
bn
-0.19265 0.(Apple's )ashow
1 setTxMode
1 fs
bu fc
```

```
2 F /|______Times-Bold fnt
bn
-0.22734 0.(LaserWriters)ashow
1 setTxMode
0 fs
bu fc
2 F /|______Times-Roman fnt
bn
-0.16255 0.( are )ashow
1 setTxMode
2 fs
bu fc
2 F /|______Times-Italic fnt
bn
-0.19680 0.(PostScript)ashow
1 setTxMode
0 fs
bu fc
2 F /|______Times-Roman fnt
bn
-0.18655 0.( printers.)ashow
F T cp
%%Trailer
cd
end
%%Pages: 1 0
%%EOF
```

As a first step into a better understanding of PostScript, let's take a look at what some of these program statements mean.

First, a percent mark followed by an exclamation point, `%!`, begins every PostScript file. Double percent marks, `%%`, mean that a comment follows and is not run as part of the PostScript code.

You can see that the code was created from MacWrite on a certain date. The comment, `%%BoundingBox`, gives the page's dimension in PostScript coordinates. To measure everything, PostScript starts at the lower left corner as the beginning point, 0,0. Measurements on the page are in increments of 1/72 inch or, basically, one point.

The printable dimensions of this page are described by the bounding box statement `30 31 582 761`. If you divide each of these by 72, you get inches. The printable area of the page will appear as in Figure 11.1.

The font size is described by the statement `12 fz` and the fill of each character's outline is in full black, `0 gr`.

The Not-Quite PostScript File

A PostScript file generated using Command-f doesn't give pure PostScript, but rather a hybrid of PostScript created according to Apple's conventions.

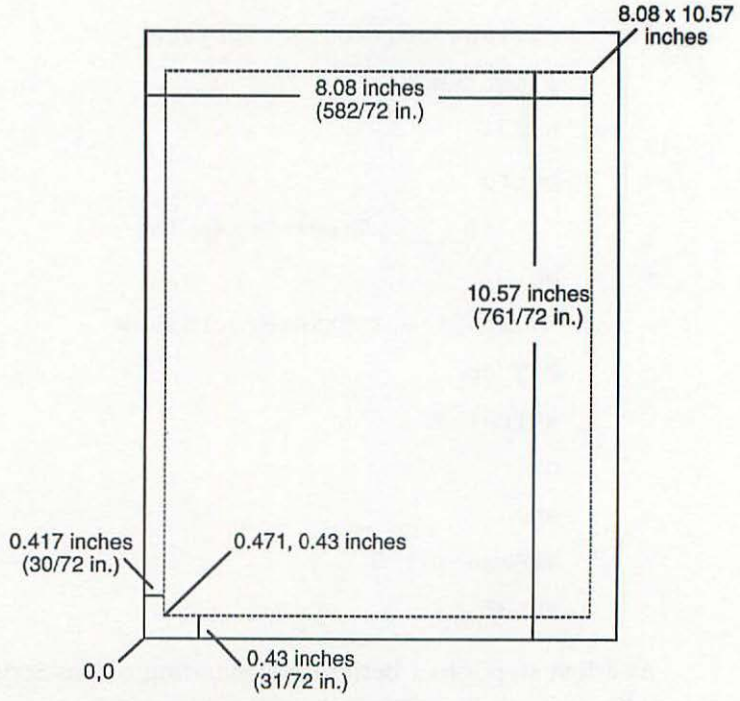


Figure 11.1. Rectangle with page dimensions: The bounding box, or active area, in our PostScript example from MacWrite.

For example, the position of the line of text is described by the statement `9 10 gm`. If the line were lower on the page, the first number would be larger. If it were tabbed to the right, the second number would be larger. You will note that this doesn't adhere to PostScript's position numbering system described above. There is a further translation to pure PostScript that takes place using the LaserPrep file that is in the printer's memory. Therefore, what you get when you create a PostScript file is mostly PostScript, but not quite *pure* PostScript.

From our example of a PostScript file, you can also see the changing of the text font from plain, or roman, to bold, to roman, to italic and back to roman as the sentence is built. The statement showing that the text is in 12-point size is the `12 fz` about half way through the file. Above it is the statement `0 gr`. This sets the shade of gray and is composed of a number between one (white) and zero (black). In this case, the text characters are black.

Now, what good is all this? Well, truthfully, not much, as it stands. You can save a few files as PostScript (pseudo-PostScript, actually) and look at them, having opened them with your word processor. This way you can learn a bit about PostScript, but the files won't work if you send them to the LaserWriter using PSDump or PSTester. They need to be converted into pure PostScript.

If you start boning up on PostScript, you'll be able to figure out how to convert these files into pure working PostScript. First of all, you don't see the magic Showpage command that tells the LaserWriter to actually print the page. There is also a program that will convert MacDraw files into a working PostScript format. It's called Post-A-Matic and, although it sounds like the name of a food processor, it's a PostScript processor. It is available for a nominal charge from many local user groups, from Educomp, or directly from Peter Bennett, the author of the program. Contact him at Graphic Presentation Charts. Post-A-Matic does a quite thorough conversion of MacDraw files, but only a partial conversion with text files.

"So what?" you may ask. Well, with some fairly simple changes, you can perform some very interesting tricks: for example, you can make the text stretch, travel around in a circle, slant uphill, or fill with a pattern.

There's one thing wrong with this approach: making a PostScript file from a Mac application. Apple doesn't make a full conversion to PostScript with the Command-f routine. To get this to print, you would have to add a few things. Don't worry about it now; we'll get to it soon.

In the meantime, you're learning about PostScript programming. Really, anyone can do it. We are about to discuss some very easy ways of going about it. I'm not a programmer, but I can use PostScript directly, and when I have, everyone asks me how I got the results I did. I tell them that I programmed it directly into the LaserWriter. So can you, read on.

Using PostScript to Tap Your LaserWriter's Power

You don't have to be an expert to have PostScript's power behind your work. There are PostScript routines already written that you can easily modify. The following one is adapted from a public domain program available through user groups. When run on the LaserWriter, it produces the text shown in Figure 11.2.

```
/master /Times-Roman findfont def
%Set up a standard 1 unit font to be used
% later in makefont-setfont operations.

%%
master [16 0 0 16 0 0] makefont setfont
%Create a uniformly scaled 16 point font.%
234 504 moveto
(The Apple LaserWriters are examples of) show

master [12 0 0 16 0 0] makefont setfont
%Create a condensed 16 point font.%
234 488 moveto
(the highest art derived from the combining) show

master [8 0 0 16 0 0] makefont setfont
%Create a very condensed 16 point font.%
234 472 moveto
(of art and technology. In every era, there) show

master [20 0 0 16 0 0] makefont setfont
%Create an extended 16 point font.%
234 456 moveto
(comes to the fore a unique combination) show
```

```
master [25 0 0 16 0 0] makefont setfont
%Create a very extended 16 point font.%
234 440 moveto
(of forces that move cultures) show

master [16 0 4.36764 16 0 0] makefont
%Create a 20 degree obliqued 16 point font.%
            setfont
234 424 moveto
(forward on their slow trek to achieving
greatness.) show

master [16 0 -4.36764 16 0 0] makefont
%Create a -20 degree (backward) oblique
% 16 point font.%
            setfont
234 408 moveto
(You have the power that the ancients were denied.)
show

showpage
```

Let's examine how it works. First, you can see that Times Roman is the font to be used throughout. Next, you'll see a string of numbers,

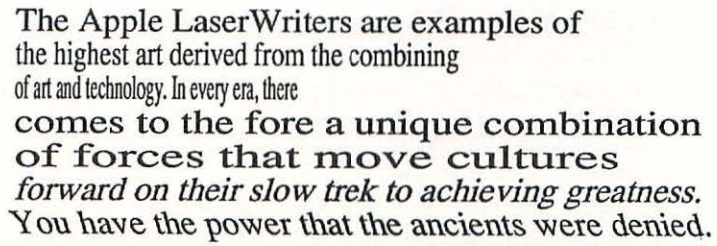


Figure 11.2. Text: A few simple things you can do with text in PostScript.

`[16 0 0 16 0 0]`. This is the font matrix used to describe the following string of text characters to be printed. Text to be printed is always inside parentheses to indicate that the contained characters actually print and are not part of the program commands.

You'll figure out what the font matrix does if you study the relation of the program to its output from the printer. For example, the second three numbers in the matrix describe the vertical dimensions in terms of scale, orientation, and position. Note that throughout the above program the second three numbers never change. Thus, the characteristics of the vertical dimensions never vary. The first three numbers describe the orientation of the font's horizontal dimension. Thus, in the first printed line, there is no change; it is a true 16-point font. For the second line, the characters are printed in a 12-point horizontal space, the third line in an 8-point spacing, the fourth is expanded to 20-point width, and the fifth is expanded up to 25-point width. Then the third number in the string is changed to add an angle which obliques the characters.

To add the angling to the font, one uses the tangent. You can see from the last line that the obliquing can be negative, too. Note that all characters remain 16-point in their vertical dimension.

Now find in the program the two number groups before each `moveto` command. These tell where each line will be printed. In PostScript, the coordinates always begin at the lower left corner of the page. You'll see that each line begins at 234. This means 234/72 of an inches, or 3 1/4 inches from the left edge of the page. This is precisely where the text prints and is the exact left margin of the text block. It's just like setting a margin or tab. You can change any of these coordinates and move the lines back and forth across the page.

Similarly, the second coordinate changes with each line. Note that the number gets smaller: that is, each succeeding line is printed closer to the bottom of the page. Remember that PostScript numbers everything from the bottom and from the left edge.

Finally, there's the command `showpage`. This is the PostScript command to actually print the page. Only after receiving the `showpage` command will the LaserWriter or Linotronic print the page.

You can change most of these controlling parameters to create some very interesting effects. For example, the rotated text shown in Figure 11.3 is from a very minor change in a program obtained from a user group.

Help From Programmed PostScript

There are several commercial programs that are available to simplify the creation of fancy PostScript output. Use a few of these and you'll really begin to see the power and possibility of PostScript. As wonderful as page layout

Figure 11.3. Spiral of name: Anyone can create special effects like this. PostScript really is this easy, and your LaserWriter is ready and waiting.

programs are, they only begin to tap the richness of effect that PostScript can provide.

First, look into Cricket Draw. This is a PostScript graphics program that also generates a separate window showing the PostScript programming code that corresponds to the graphic window, and you can add modifications of your own in the PostScript window and test their effect by printing the results on your LaserWriter. There's also a help function that defines most of the PostScript commands or operators. Note, however, that Cricket Draw's page coordinate system is the reverse of Adobe's, and it uses zero for white and one for black, which is exactly the opposite of Adobe's. All in all, however, Cricket Draw is an excellent drawing program and a fine way to learn PostScript (see Figure 11.4).

There are other PostScript programs as well. For example, LaserFx by Postcraft International is a PostScript utility that creates a wide variety of PostScript effects when used either alone or to create EPS files to include in most page layout programs. For instance, LaserFx can slant the text, fill it, rotate it, add shadow perspective to it, and effect many other very fancy changes in it. With the original version 1.1, you won't see the special effect on the screen, however. This shows up only when you print from the LaserWriter. PICT and paint files from MacDraw or other programs can be brought into LaserFx so that special PostScript effects can be added.

LaserFx (Version 2.0) is slated to have an accurate screen representation. LaserFx files can be saved in PICT, EPSF, PostScript, or Microsoft Word 3.0 format for imbedding into a wide variety of programs. LaserFx is available

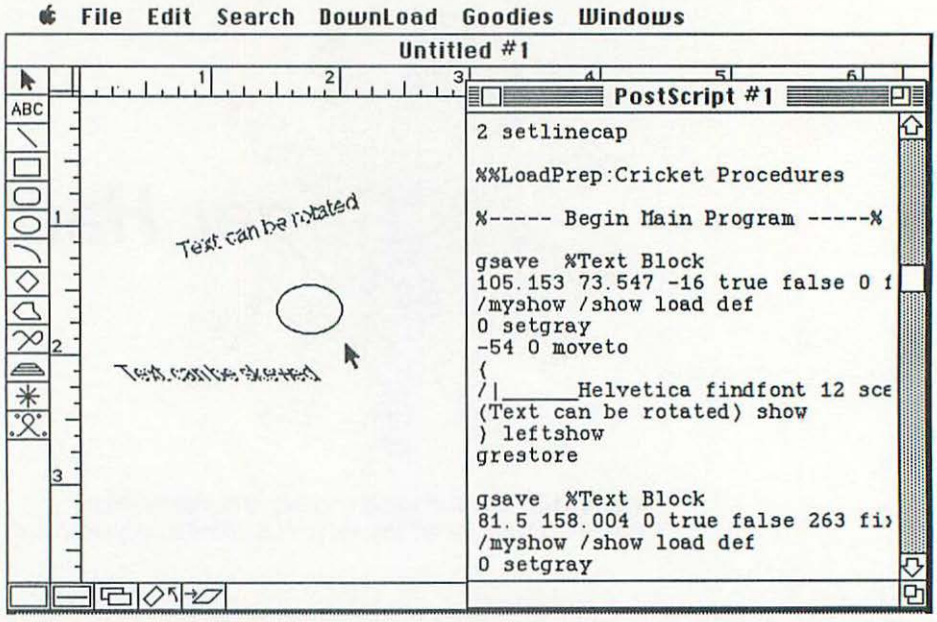


Figure 11.4. Screen image: Cricket Draw can display a PostScript program window and has a Help file to explain PostScript terms.

in Macintosh and MS-DOS format. Apple IIgs and Atari ST versions are planned.

Postcraft also has several add-on modules for its LaserFx package, which are called LaserFx-PAKs. They include an almost bewildering variety of effects for text. Your headlines may never look the same.

Desktop Catalog offers several PostScript programs including Easy.ps ButtonPak, which creates circular type and border designs used for printing logos and round buttons.

Advancing a bit into real PostScript will be helped by another utility from Postcraft, Postility. This relatively inexpensive program provides a text editior for entering PostScript statements, allows the conversion of PICT files to PostScript code, enables the inclusion of PostScript in PICT files, downloads files to the LaserWriter, converts EPSF files to PICT or text, and can directly print EPSF files to the LaserWriter.

There's also LP Text from London Pride. This Macintosh program allows the creation of text in sizes up to 999 points, compressed, expanded, angled, rotated, or filled with any shade of gray. Circular and shaded text is also supported, and EPSF files are created so that they may be imported into page layout programs such as PageMaker—a great way to add special effects to your newsletter or brochure.

Another PostScript utility is PostHaste from Micro Dynamics. This is an inexpensive PostScript editing and downloading program that works through AppleTalk and sends back error messages from the printer. This is a great help in trying to figure out what went wrong. PostHaste also comes with a number of prepared cookbook examples which can be readily modified to create a wide variety of interesting effects. This or any of the above programs could easily be used by beginners.

More Advanced Help

Stepping a bit more into the inner workings of PostScript is LaserCraft from Nikrom. This Macintosh program is crammed full of utilities and handling routines for text and graphics. LaserCraft will take you on a step-by-step tour of PostScript, and no, you don't have to be a programmer to use it. Nikrom also offers LaserOPTICS, a collection of PostScript routines that produce optical distortion effects to text that can imported into most publishing packages. An IBM-PC version is being developed.

With LaserTalk from Emerald City Software, you don't have to print your PostScript program to see what it will look like. There's a screen preview that lets you see a bit-mapped representation of what you are programming. It also works as you go. With each added line or change, you can see the effect on the resulting image. There's also an online PostScript command dictionary to help you remember what each command does.

Even MacWrite can produce some really beautiful output when coupled with a special non-printing font that acts as PostScript command input. When the LaserWriter encounters this special font, it reads it as PostScript rather than text and uses it to execute PostScript commands in the LaserWriter. You'll be able to find this font from a good Macintosh user group. It's called PostScript Imbedded in MacWrite or PostScript Escape. The LaserWriter knows to interpret any text in PostScript Escape as pure PostScript commands and not just text to be printed. You should remove all `grestoreall` and `initgraphics` commands when imbedding PostScript routines into word processing documents. Then, at the beginning of your imbedded PostScript, add the command `gsave` and at the end add `grestore` if they are not already present.

PostScript can be added into Microsoft Word or WordPerfect, too. Be sure, however, to delete any `Showpage` command at the end. The word processor will take care of printing the page.

If you're using an IBM-PC with your PostScript LaserWriter, look into Lexisoft's PS Portfolio, a collection of 25 PostScript routines that tap the LaserWriter's more sophisticated graphics capability. You can change any of these with your word processor, and then send it to the LaserWriter using DOS or any of the PC desktop publishing programs that supports EPSF.

Getting these PostScript files into some of your other programs can be a bit tricky. First, try to save the PostScript routines as EPSF files. These will open and place in most page layout programs. If you have a text-only PostScript effect that you want to include in a PageMaker or Xpress layout, try adding the following PostScript notation just after the beginning `%!` or `%%`:

```
%%BoundingBox 0 0 612 792
```

This will put your PostScript effect on the page, and the remaining text and graphics may then be placed over it. You won't see the effect until it prints from the LaserWriter, however. By changing the bounding box dimensions or by using PostScript's translate command, you can move the PostScript effect to different locations on the page.

Using Your LaserWriter's Interactive PostScript Mode

Since the LaserWriters are intelligent communicating printers, you can talk to them and send them messages, and they will talk back to you. That may seem a bit silly, but it's a real possibility if you want to do some of the fancy things that PostScript is capable of generating.

First, there are several ways to send PostScript files from a Macintosh, including several programs that are public domain and that should be available from user groups. Among them are PSDump, PostScript Worker, ExecutePS, LaserFeeder, LaserStatus and PS Tester. PSDump and PS Tester work through AppleTalk connection to the printer. CricketDraw also sends PostScript files to the LaserWriter. These programs allow communication with the LaserWriter's PostScript interpreter in "batch" mode: that is, sending a complete file all at once.

Second, you can use the LaserWriters interactively. In interactive mode, you actually type the PostScript code directly into the LaserWriter. All you need to do is simply to cable your computer or terminal to the LaserWriter's serial port and send the data using a telecommunications program—almost any one will do. First, turn off everything—computer, printer, everything. Then set the LaserWriter's baud rate switch to 9600 and connect it to the modem port of the Mac using an old ImageWriter or modem cable to the LaserWriter. If you have a PC, use a cable for the H-P LaserJet. A null modem may also be used. Do not have AppleTalk and the RS-232C serial interface hooked up at the same time. Then turn on the printer and wait for a test page. It should show that the communication rate is 9600 baud by printing "9600" where "AppleTalk" usually shows. If that's OK, turn on the computer and start the communication program. Set the parameters to:

Terminal	*Compatibility*	*File Transfer*
Terminal: VT-100	Baud rate: 9600 baud	Method of transfer: text
Mode: ANSI	Bits/character: 8 bits	
Cursor shape: underline	Parity: none	
Character set: US	Handshake: none	
Line width: 80 column	Connection: another computer	
Select: on line, auto repeat, auto wraparound	Port: modem port	

Then send a Command-T (Control-T on the PC), which should report that the printer is idle or waiting. You should see the following information displayed on your screen:

```
%% [status: waiting; source serial 9] %%
```

If the printer is not in its idle or waiting state, press Command-D (this is an end-of-file character in PostScript) and then another Command-T. Then type "executive" and press Return. You should now see on your computer's screen the number of the PostScript version present in the printer's interpreter and the copyright year followed by PS. This last message, PS, means that the printer is now waiting for you to enter a PostScript file or to type one in while it waits.

```
PostScript (tm)  version 47
Copyright (c) 1984 Adobe Systems Incorporated
PS>
```

Your LaserWriter may not have the version of PostScript shown above. That's all right.

To check that the LaserWriter is ready, you can type in "showpage", the PostScript command to print the page. It should now print a blank page. When you type in commands, there are a few editing commands you can use. For example, use Command-H to backspace and erase one character, Command-R to display the current line again, Command-U to erase the current line, and Command-C to begin the entire PostScript procedure again. While all of this may seem similar to the information in Chapter Three, the procedure described above is interactive—that is, you send directly in real

time to the LaserWriter. In doing this, you will see each character sent to the printer echoed back onto your computer display.

Here's a quick PostScript program that sets the definition and size of a typeface, places it at a defined position on the page, and prints your name at a thirty degree tilt:

```
/Times-BoldItalic findfont
72 scalefont setfont
100 100 moveto
30 rotate
(type your name here) show
showpage
```

Sending a Command-D ends the PostScript session. Congratulations, you've just entered the world of PostScript.

You can use your terminal communications program to send prewritten PostScript files that you've made. Just save them in "text only" and then follow the same procedure to the PS> prompt. Then send the text file. Yes, it's as simple as that.

PostScript is there waiting for you. If you use the LaserWriter for publishing, yet haven't tried creating your own special effects using one of the off-the-shelf PostScript programs or one from the public domain, then you're missing out on a lot of the action. It's really easy, and you'll be surprised at how much you can do.

CHAPTER **TWELVE**

The LaserWriter II SC

The Affordable Macintosh Laser Printer

A Quick Look at QuickDraw

Fonts of a Different Kind

What You Get and What You Don't

Not everyone needs the features that PostScript makes available. There are lots of average users who want the clean, crisp print of a laser without the added expense and complexity of PostScript. The people at Apple have been aware of this for some time now, even though they were beaten to the market by General Computer's Personal Laser Printer by a few months. Apple had been quietly working away on their own design of a QuickDraw printer. Now, for under $3,000, you can have the handsome output of a laser printer complete with all the great type and graphics that you've become accustomed to on your Mac.

For many users, the output of Apple's LaserWriter SC or General Computer's Personal Laser Printer is good enough. After all, there's always a balance between price and performance, and QuickDraw, when operating a laser printer's graphics, does a very good job, at least for the average user. These two QuickDraw laser printers are a good compromise between performance and price.

Remember, though, that you don't have PostScript capability with the LaserWriter II SC, which means that with it, programs like Adobe Illustrator, Aldus's FreeHand, Cricket Draw, Quark's Xpress, and Altsys's Fontographer either won't work at their best or simply won't work at all. Printing documents from graphics or page layout software containing EPSF files won't work, either.

The Affordable Macintosh Laser Printer

Price is certainly a factor in every purchase, especially considering the thousands of dollars that laser printers cost, but there's no question that improved technology and enhanced features are being added while prices actually fall. Consider that the original Apple LaserWriter cost $6,995 and had just four typefaces, one of which was Courier (Who on earth wanted to use Courier?). Today, the LaserWriter II NTX costs less— $6,599!—and you get lots and lots of typefaces, a speed demon 68020 processor, 2 megabytes of memory with the ability to add lots more, and a SCSI port for the capability of storing an almost unlimited number of fonts on attached hard disks. The Hewlett-Packard LaserJet, with 64K of memory and no capability for downloaded fonts, cost $3,495 when it was introduced in 1984. How things change! The LaserJet II, introduced in early 1987, offered 512K of RAM, the ability to add up to 4MB for handling a greater number of downloaded fonts,

and two font cartridge slots, instead of the single one offered on the earlier model.

Today, some laser printers are being priced at below $1,700 list and, depending on the future currency exchange between the dollar and the Japanese yen, are probably about leveled out as far as price changes are concerned. New features will certainly be added, but prices won't be headed down too much further.

Having Macintosh laser printing for considerably under $3,000 is, therefore, a long way from the days of the original LaserWriter.

Apple's SC versus General's PLP

In describing the LaserWriter II SC, it seems inevitable to compare it to General Computer's Personal Laser Printer. Both are targeted at basically the same purchasers, so if you're thinking about adding laser quality to your Mac system, read on.

Let's look at some of the similarities between the two. Both use the SCSI port to hook up to the Mac. You can't use the standard printer port; it's too slow for transferring the large amount of data needed for building the pages from a laser printer. Both printers' drivers convert Apple's QuickDraw routines into full page 300 dots per inch bit-mapped images. These QuickDraw files contain the same graphics routines that are used to generate the display images you see on the Mac's screen. In a like manner, the ImageWriter driver converts them to a bit-map (though lower resolution) for printing on Apple's dot matrix printer.

Now, let's look at their differences, and this is where Apple's model begins to cost more. General's Personal Laser Printer is a "slave," or "dumb" printer, which doesn't mean that the output isn't any good—it is. What it means is the processing of the page's image into a raster scan for imaging on the laser printer's light-sensitive drum isn't done by the printer. It's done by your Macintosh and its microprocessor. There is no microprocessor chip in the Personal Laser Printer.

Nor is there memory in the Personal Laser Printer. It uses the Mac's RAM to assemble and store the image before sending it to the printer. All this takes time, and it's taking your Mac's time, which is important difference between Apple's LaserWriter II SC and General Computer's Personal Laser Printer.

Apple's LaserWriter II SC has the same Motorola 68000 microprocessor that is in a Macintosh SE, and also the same amount of memory—a megabyte of RAM—for processing and storing the bit-mapped image prior to printing. With this you can be doing other things with your Macintosh, rather than having it do the printer's work.

Of course, General Computer's approach was to keep the cost as low as possible by having the host Macintosh do as much of the work as possible. Cost savings almost always have a trade-off, and this one is in the speed of

the printing. You'll see that the LaserWriter II SC prints much faster, especially on bit-mapped files or long text documents. You save some money with General's PLP, but you spend more time.

Apple has also designed the LaserWriters as a family. A simple, dealer-installed board swap can convert your QuickDraw SC model into either of the PostScript versions. General's Personal Laser Printer can also be upgraded to its PostScript model, the Business LaserPrinter, described in Chapter Fourteen, but at the present time, there's no way to upgrade this to NTX standards.

Having a simple, dependable upgrade path can be worth a little extra money, especially for business users who will also be getting much of the computing power of a Macintosh SE built-in for printing performance. When you look at the extras Apple built in, the prices are quite close.

There are a few additional differences. The Personal Laser Printer is built around a 6-page per minute laser engine. Apple's contains an 8-page per minute design. It makes somewhat less sense to upgrade a 6-page per minute engine to PostScript than to start from an 8-page per minute design.

General's entry-level printer comes with a set of fonts that are designed to be scalable—you can create sizes from outline fonts. Apple's current implementation of the LaserWriter SC uses bit-mapped typefaces. Don't confuse these with bit-mapped screen fonts or bit-mapped ImageWriter fonts. These are high quality designs specially created for the LaserWriter SC, and each size is tuned to give the best appearance at that size. You also get the typestyles that are used in publishing: Times and Helvetica, in addition to Courier and Symbol. Certainly there will be more developed by font suppliers as sales of the SC grow.

A Quick Look at QuickDraw

When Apple developed the Macintosh, the company wanted clear, distinct windows, dialog boxes, the ability to handle and modify typestyles and sizes—in short, it wanted a fully graphic environment. To achieve this, Apple set out to standardize the way many of the needed graphic elements—boxes, lines, arcs, fill images, ovals—were prepared inside the Mac. Thus, all the graphic routines needed to produce the screen image and then to print them out were built into the Mac's hardware. This became QuickDraw, a series of graphic routines that create the screen image. Everything you see on the Mac's monitor is due to QuickDraw—including text characters, windows, menus, and graphic objects and QuickDraw was developed for the Mac's screen resolution: 72 dots per inch.

The QuickDraw commands and routines have been imbedded into the Mac's permanent memory—the read-only memory (ROM)—and are used every time you do anything on the Mac. For example, it is a QuickDraw routine that allows you to change a character style from plain to shadow, or from plain to bold. QuickDraw also scales your text when you call for a different point size.

Printing from a dot matrix ImageWriter is done by simply using the QuickDraw description of the page being printed, but even though QuickDraw is imaging text at 72 dots per inch, there are ways to increase the quality. When printing text in the High Quality mode on the ImageWriter, for example, the Macintosh takes double the font size—24 points for printing 12-point type, for instance—and scales it down by 50 percent, thus squeezing more dots into the smaller space. By taking the dot image for a 24-point size and printing it in a 12-point space, you can achieve a very nice print quality, but it's still not laser quality.

Scaling by Fourths

On the LaserWriter II SC, the QuickDraw routines will take a font four times the printed character size and use its bit-map to print in the smaller space. For example, when printing 12-point Helvetica, the SC is designed to use a 48-point size scaled down to fit the 12-point space because QuickDraw is designed to work at 72 dots per inch, the standard Mac screen resolution. The LaserWriters work at 300 dots per inch, consequently a four times reduction to come close to the laser printer's resolution (more about this in the next section on fonts).

As mentioned above, QuickDraw also creates the style variants from the plain (roman) font. For instance, it creates boldface characters by mathematically thickening the character horizontally by a set number of pixels, and it creates the italic style using a QuickDraw skewing routine to tilt the character over a set amount.

For graphics, the scaling between the Mac's screen image and the LaserWriter II SC depends on whether it is a bit-mapped or object-oriented image. For objects, the image is scaled precisely to match the printer's resolution. Thus 72 dot per inch objects are scaled 4.17 times to round out to 300 dots per inch for printing.

QuickDraw can scale a bit-mapped image or pattern to any desired ratio, but the printed results will look good only if the scaling is in a whole number ratio. Thus, the SC uses a 4:1 scaling for bit-mapped images rather than the 4.17:1 ratio that would exactly match the printer's 300 dot per inch resolution. This means that bit-mapped images are 4 percent smaller than object-oriented ones when printed on the LaserWriter SC.

Special Tricks, Too

The LaserWriter II SC isn't just the result of a few evenings spent in Apple's engineering and development labs. Here's an example of the extra effort that has gone into this personal style LaserWriter.

To speed up the job of printing, some graphic objects are redrawn by the LaserWriter II SC driver to greatly reduce the amount of data that must be sent to the printer. For example, a box 8 by 10 inches with a 1/8-inch line width is, to QuickDraw, two objects—a black outline and a white fill. At 300 dots per inch, the rectangle is 2,400 by 3,000 dots, or 7.2 million dots total. Dividing this by 8 bits per byte, we see that the total is 900,000 bytes (900K). Since it must image the rectangle twice (once for the black, once for the white fill), QuickDraw really sees the object as a 1.8 megabyte object when sent to a 300 dot per inch printer. That's a lot of data and, of course, it all takes time. Therefore, Apple designed into the LaserWriter II SC driver a conversion that takes that 8 by 10 rectangle and breaks it into four separate lines, each 1/8-inch wide. Two are 8 inches long and take up 90,000 dots each, two are 10 inches long and take 112,500 dots each. Add the four together and you have a total of 405,000 dots or, 50,625 bytes—less than three percent of the normal QuickDraw routine. It's like taking a bed frame apart to move it to another room. That's easier than trying to move it while it's still put together.

The LaserWriter II SC is designed by the people who developed QuickDraw and know it inside out.

Fonts of a Different Kind

The rest of this book is devoted to describing the PostScript way of handling fonts—how the fonts can be sized to suit your desires and design, and how they can be sent to different output devices such as Linotronic typesetters. Unfortunately, the LaserWriter II SC lacks this capability. The low cost has to be due to something, and part of it is the lack of a PostScript language interpreter. The LaserWriter II SC depends on bit-mapped fonts just like the ImageWriter dot matrix printers.

Don't, however, take that to mean that the SC fonts look crude. No, in their specifed sizes, they look about as nice as the typefaces from the PostScript LaserWriters.

Shrinking Fonts to Fit

On the LaserWriter II SC, QuickDraw scales the text font in exactly the same manner that it scales a bit-mapped image, but rather than multiplying the dot pattern by four, it uses a font that already exists at four times the required size.

The LaserWriter II SC is designed to achieve high quality laser printing by using text fonts that are four times (called "4X") the size you intend to print. In doing this, the Macintosh looks to the System file for a font size four times larger than the size to be printed. Thus, if you're printing 12-point Times, it

looks for a 48-point size. This is because it is more precise to fine tune the design of a 48-point font. The larger the size, the more accurately it can be designed.

Actually, the 48-point size isn't quite 48 points. It's 50-points, or 4 percent larger to take into account the 4.17 times sizing that converts the resolution to the LaserWriter's 300 dots per inch.

What happens if you don't have the 4X font installed? The LaserWriter II SC scales a double-sized font to twice its size and then reduces it four times. Let's walk through that with an example.

If you're printing 12-point Times and don't have the 48-point size installed, the Mac will look for a 24-point size to scale up to 48 points. It then uses this image to reduce four times to print a 12-point size. The results, as one would expect, will not be as good.

What if there's no 24-point size? Well, the Mac simply scales the 12-point font to 48-points and then reduces it four times. Don't expect text that looks great.

One aspect concerning the SC's manner of generating high quality fonts is that its fonts are quite close to their designated point sizes. However, when many characters are added together in a line, there may be enough mathematical rounding to diverge slightly from what you see on the screen. Sometimes with fully justified text, you may get an uneven right margin or you may get text that, when it is formatted tightly into boxes, will touch or slightly extend beyond the boxes boundary.

We've seen that the 4X fonts produce the highest quality printing on the LaserWriter II SC. Table 12.1 shows the exact fonts supplied with the printer.

Note while looking at Table 12.1 that the 36-point and larger sizes are meant to be scaled to the lower point sizes. These are the 4X printing fonts for the lower sized screen fonts.

The three text fonts come in the plain (roman) style. The other styles, bold, italic, shadow, etc., are mathematically derived by QuickDraw from the plain typeface.

Since these fonts have the same names as the PostScript fonts for the LaserWriters NT and NTX, you will want to install only the SC fonts in your Sys-

Table 12.1 Fonts Supplied with the LaserWriter II SC

Typeface	*Style*	*Sizes*
Times	Plain	9, 10, 12, 14, 18, 24, 36, 40, 48, 56, 72, 96
Helvetica	Plain	9, 10, 12, 14, 18, 24, 36, 40, 48, 56, 72, 96
Courier	Plain	9, 10, 12, 14, 18, 24, 36, 40, 48, 56, 72, 96
Symbol	Plain	9, 10, 12, 14, 18, 24, 36, 40, 48, 56, 72, 96

tem when it is connected to the LaserWriter SC. This will avoid any font conflicts or confusion. Note also that there are additional fonts available from third party font developers.

Remembering that these are bit-mapped fonts (that is, they are made up of thousands of individual dots), keeping them around takes up lots of memory. The full set of fonts shown in Table 12.1 requires about 1.5 megabytes of storage. You can try to limit the number of fonts installed in your system, of course, but Table 12.2 offers a sampling of the sizes for just the Times typeface in each text size and its corresponding 4X size.

You can see that simply having Times available takes almost a half megabyte of disk space. Now could be the time for a hard disk if you've been putting off adding one to your system.

What You Get and What You Don't

Buying a LaserWriter II SC is, essentially, a trade-off. You save a reasonable amount of money. For many of us, that's a key benefit, especially when the printed quality, if you use the SC the way Apple intended, is virtually as good as its other, more costly laser printers. Add to this the fact that Apple's LaserWriter II SC is part of a family of laser printers designed to work with the Macintosh by the same people that made the Mac. If you decide that your work needs the benefit of PostScript's font variety and the ability to go to a typesetter, then a simple board swap by your local dealer (in exchange for some money, of course) will turn your QuickDraw SC printer into a PostScript NT model. You're therefore not entering a dead-end street with the LaserWriter II SC.

You also get the entire laser printer, controller and all. The SC doesn't have to depend on your Mac to do all the image processing. This is done inside the printer with a Motorola 68000 microprocessor and stored before print-

Table 12.2 Storage Requirements for Times Typeface

Size	*Bytes*	*4X Size*	*Bytes*	*Total*
9	6494	36	22702	29196
10	7232	40	30848	38080
12	7126	48	41214	48340
14	7924	56	55138	63062
18	9334	72	73010	82344
24	12286	96	149908	162194
				423216

ing in a megabyte of memory inside the printer. In essence, you get a separate computer inside the printer.

You also get high quality, professional typefaces such as Times and Helvetica. You don't get clones or "almost like Helvetica"; you get the official Merganthaler designs.

You also get an 8-page per minute laser printing engine, not a 6-page per minute model. Not much difference, you say? Well, it's 33 percent more speed, and you probably have appreciated the extra speed of a Mac SE or a Mac II. Speed is important, especially if you upgrade your system to shared PostScript capability. You will appreciate the increased printing speed when you share the printer with other users.

In addition to these benefits, you get Apple's expertise in designing a printer that uses its own QuickDraw graphics and text routines. The single example about breaking the rectangle into four lines mentioned above should convince you that they've put a lot of clever minds to work designing this hardware/software combination.

Nevertheless, you are giving some things up—sharing, for example. The PostScript models can link thirty users together to share a single printer, thus bringing the per-user cost down dramatically. General Computer has developed the PLP Share adapter for hooking multiple Macs into one of its printers and it seems likely that Apple or a third party developer will also develop a way to network the LaserWriter II SC.

Furthermore, you don't get either the unlimited scaling of typefaces that you have in the higher models nor the wide variety of built-in typestyles. The SC has a rather limited variety and requires quite a lot of memory, too.

You also have fewer choices about changing the size of your printed copy. The PostScript LaserWriters allow you to scale the printed page between 25 percent reduction and 400 percent enlargement. The LaserWriter II SC gives you just two choices: 50 percent and 75 percent reduction, with no enlargement (Figure 12.1).

Finally, you lose one of the great benefits of PostScript—the ability to send the file to any PostScript output device, whether a laser printer, typesetter, or ink-jet or thermal color printer.

It's really all summed up here:

PostScript Printers	*QuickDraw Printers*
hard disk not required	hard disk required
wide selection of fonts	fonts currently limited
can use PostScript effects	no PostScript effects

(continued)

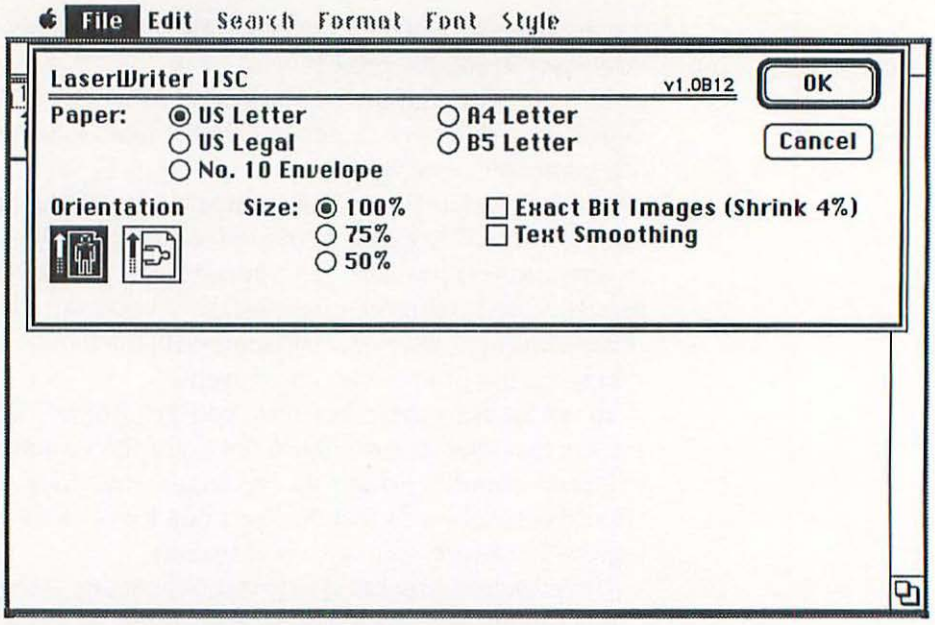


Figure 12.1. Screen image: The LaserWriter II SC Print Menu.

(continued)

PostScript Printers	*QuickDraw Printers*
same file can be typeset	not file-compatible with typesetters
spoolers help regain use of computer	spoolers do not work
can be used with wide variety of computers	useable only with Macintosh computer
easily shared and networked	generally not shared

Upgrading your LaserWriter II SC to PostScript is really easy. In fact, it's so easy that you should look into doing it yourself if it can save you some money. If your dealer is going to charge you anything significant (over $5, for example), be advised that if you can use a screwdriver, you can easily install the upgrade board. Apple did a nice job of design, and it won't take but two or three minutes to swap the boards. Make sure you can return the old board to your dealer as part of the credit. Don't let a dealer try to charge you for the installation. If he does, go somewhere else.

With a savings in the original price of the SC, you must, of course, expect to give up some of the features of more expensive models, but there's little question that Apple will, in the future, be expanding the capabilities of their QuickDraw routines to fall more in line with current technology.

An improved QuickDraw can mean only fancier effects and higher quality results from the LaserWriter II SC and its progeny. Things will only get better in the world of QuickDraw printers, and today they represent quite a good value for single users.

CHAPTER **THIRTEEN**

The Practical Problems of Printing

Printing Problems and How to Fix Them

Font Problems

Graphics Problems

Other Printing Problems

Maintaining Your LaserWriter

One good thing you'll hear from people who use Apple computers is that they are designed as a package system. Oh, some may not like paying what they may think or believe are higher prices for an all-Apple system, but it's usually pretty simple to get things up and going, which is worth money to most of us.

The same is true with the LaserWriters. They're almost ludicrously easy to hook up to your Mac. Even networking a bunch of Macs together to share a LaserWriter is easy.

Since time is money for most business people, it's a good system and is popular as a result. Ask desktop publishers who put their own equipment together around an MS-DOS system. You'll often hear tales of woe and tribulation.

Apple's LaserWriters are easy to use and, in reality, quite reliable. Nevertheless, nothing is perfect. Things can go awry.

This chapter isn't meant to be a substitute for the operating manual that came with your LaserWriter. Please read it, too, and refer to it for cleaning procedures and routine troubleshooting. A few of the same points will be covered here, but you should look in the manual first.

Printing Problems and How to Fix Them

The LaserWriters aren't foolproof. After all, they're based on photocopier technology. Just ask any office manager what their most troublesome piece of office equipment is, and the chances are you'll hear "X!c%*&! photocopiers." Don't let this alarm you too much. Laser printers, in general, are sturdy and dependable. Lots of people use them month in and month out without ever even thinking about them. We don't live in a perfect world, however, and, similar to your automobile, a bit of preventive maintenence on your LaserWriter will pay off well.

First of all, clean the LaserWriter regularly. Many of the service calls on ailing laser printers are necessary because someone has ignored the instructions about routine cleaning. Please, please, clean your LaserWriter regularly. After all, it's a big investment, and it's worth it. You don't want to be without it, either. If it's used quite a bit, clean it once a week, and brush off the felt wiper pad that keeps the fuser rollers clean. An old toothbrush works just fine.

Examine the test page for smudges, smears, streaks, and light or splotchy areas. That's why there's a test page. This doesn't mean that you have to

depend on the test page for an indication that something's wrong. No, a simple examination of your regular work will do that.

If you don't think that you need the test page to show you when things deteriorate, you can turn it off. All you need is a PostScript file-sending program such as PSDump or PSTester and a public domain program called Disable Page. DiskTop from CE Software will also do the trick. An even simpler procedure is to pull the paper cassette out each time you turn on the printer. Leave it out for a minute or so, and then reinsert it. The test page sequence will have "timed-out," and you'll be free of the test page.

When you clean the printer, take the toner cartridge out each time and gently rock it back and forth a few times. This redistributes the toner powder which otherwise tends to channel and begin to feed unevenly. This is an easy bit of preventive maintenence.

The LaserWriter also needs certain software for it to work properly. LaserWriter and LaserPrep must be in your System folder, and you should generally be using the very latest versions. One exception to this is that if you have a 512K Mac hooked up to your LaserWriter or AppleTalk network, you'll find that LaserWriter 5.0 is simply getting too big to run in the limited memory. If this is the case, then LaserWriter 4.0 should be used throughout the entire network.

Don't mess with the LaserWriter software. It belongs in the System folder, and the Mac looks for it by name. Don't change the name of the LaserWriter or LaserPrep files, or things won't work.

There are occasionally some specific problems that can arise. Let's hope they don't, but in case they do, here's some first aid.

Font Problems

Usually things work well with the Macintosh, but there are times when you get either a font that looks funny or the wrong font altogether. There's usually a reason, and you might just find it below.

Don't change the names of the font files. Change only the names of files that you've created with your application software. This will keep you on the safe side.

When you don't get the right fonts printing in your document, there are several factors to consider. First, are you sure the text is the correct typeface in the original document? Make certain by placing the cursor in the text and looking at the Font menu. The text face at the cursor's position will have a check mark next to it in the menu.

The best quality type results from using one of the LaserWriter fonts when you originally create your documents. This means that you should be using Times rather than New York, and Helvetica rather than Geneva. If you have

used a bit-mapped Imagewriter font such as New York, convert the document to Times before printing on the LaserWriter. This will get you the best letter spacing.

The problem of substituted fonts often occurs because the Macintosh generally dictates what font your application starts up with. In most cases, it's 12-point plain Geneva. With one of the public domain programs, AppliFont, ApFont, Afonts, or PRAM, you can set the font you want so that your word processor or graphics program automatically begins using your favorite LaserWriter font. It remains installed until you remove the battery from the Mac. If you have a Mac II, in which the battery is permanently soldered in, get ApFont. It is a CDEV (a computer control resource that is placed in your System file and accessed from the Control Panel), and its font setting can be easily changed whenever you want.

If you're using a downloaded font, you might be getting the bit-mapped screen font printed in your document if you haven't placed the laser font file in the System folder. When the LaserWriter looks for the font prior to downloading, it looks in the System folder. If it's not there, it will download the corresponding screen font, and you'll get the bit-mapped version in your printout. Make sure that the font files (they usually look like a tiny LaserWriter and have the name of the font and style in the file name) are present in the System folder. Don't make the mistake of putting them inside a folder inside your System folder. They are unlikely to be found.

Check, too, that there is only one System present. Since fonts and desk accessories are installed into the System file, the presence of two Systems could have your Mac starting up with the wrong one, i.e., the one without your fonts. Since System files can get buried on hard disks, search yours carefully to make sure there's only one.

When you install fonts for downloading, remember that many come with separate bold and italic files. These should be installed if you plan on using these styles. Otherwise, the Mac will create them from the plain (roman) font, and they will be less than optimum in appearance.

Text entered in MacPaint and in other bit-mapped painting programs will be lower in quality. Try using a program such as SuperPaint, which has both drawing modes. Enter the text using the draw mode or first create the graphics in MacPaint, select the image using the Lasso tool, Copy to the Clipboard, and then Paste the bit-map into a new MacDraw document. Add your text using one of MacDraw's LaserWriter fonts.

If you're using MacDraw and find the wrong fonts printing out, you've probably created the drawing on one system and you are printing it on another. MacDraw, contrary to the way Apple wants Macintosh software to be structured, keeps fonts numbered in the sequence they were installed in the System file. The next Mac you use may have them installed in a different

order. Either use the original System, or reselect the text portions of the MacDraw document and change the fonts to the desired one.

You may also get the wrong font printing out from software other than MacDraw. Here's how that can happen: The Font/DA Mover is smart enough to know when there is a conflict in Font ID Numbers and will renumber the newest one accordingly, which is no big deal until you print your document from a different system. Its font may still have the original Font ID Number.

Occasionally, some of the option characters will also print out differently. For example, the bullet produced by pressing Option-8 will print as the Japanese Yen character ¥. This is because Adobe's PostScript has slightly different key assignments from Apple's. Try turning off the LaserWriter and starting over again. This usually works.

You may also have a problem printing certain styles, such as bold or shadow, from the LaserWriter. The reason is simple—these styles aren't built into some of the typeface families resident in the LaserWriter's ROM. For example, there's no bold or italic in Zapf Chancery. You can make them on the Mac's screen, but they won't print from the LaserWriter. They just aren't there.

Note that Ventura Publisher has several patch programs that help the LaserWriter recognize PostScript fonts. If you're having trouble getting new typefaces to print, check with Xerox for a fix.

Graphics Problems

MacPaint and other 72 dot per inch graphics programs and clip-art files made from them can get blurred or have white tint lines across the image when printed on the LaserWriter. Read Chapter Eight about scaling these graphics files to 96 percent of their original size. This helps match the dot pattern of the LaserWriter with that of the graphics file so you don't get degradation in print quality.

If you get an opaque rectangle around a bit-mapped graphic that you have copied into your page layout program, try bringing the graphic in using the Place command. This brings the graphic only; simple Copying and Pasting will bring the background, too, and it will be opaque. If the receiving software lacks a Place command, try Copying through the Clipboard using the Lasso.

How can you cut and paste, or import graphic images that are larger than the screen size? There are several ways, but Silicon Beach's Paint Cutter, in its Accessory Pak 1, is a good choice.

SuperPaint is a popular graphics program because it combines a paint mode with an object-oriented one, which is like having MacPaint and MacDraw rolled into one. However, you may find that SuperPaint's paint and draw layers don't print out exactly aligned. This is because SuperPaint was originally written to slightly compensate for the early LaserWriter drivers

which printed bit-maps and objects to slightly different scales. Check with Silicon Beach for a fix.

Importing Cricket Draw into PageMaker usually works well, but if you have a problem bringing EPSF files from Cricket Draw into PageMaker, check the version number of your Cricket Draw program. Version 1.0 has an EPSF format that was an early one which is not completely compatible with PageMaker. CricketDraw 1.1 works fine with PageMaker 2.0 or higher.

If you are bringing a Cricket Draw graphic into a program that doesn't accept EPSF files, copy the graphic to the Clipboard or Scrapbook, holding down the Option key while copying. This technique creates a bit-map image for the screen while retaining the PostScript file for high quality printing.

Scanned files can be the source of several potential problems. Probably the most common is the presence of a superimposed pattern that shows up in your scanned graphic. This is a moiré pattern that happens when halftones are halftoned again. Making a dot pattern from a graphic that's already a dot pattern will result in this wavy pattern.

Other Printing Problems

What happens when nothing happens? You click Print, but there's no result? Turn off the LaserWriter (it was on, wasn't it?) and then tighten all the LocalTalk connectors. Turn the printer back on and try again.

If there's still a problem, its source could range from a bad printer port on the Mac to the LaserWriter power supply, but before putting in a service call, make sure your System contains the LaserWriter and LaserPrep files, and that AppleTalk is selected on the Control Panel and the LaserWriter is selected in the Chooser. Also check the basic power circuit to the printer and make sure the printer is plugged in.

Complex page layouts with several downloaded fonts can also cause problems. If your publication won't print or you get an "out of memory" error, try printing each page separately. You'll likely run into the offending page which will have to be modified or printed on a LaserWriter with sufficient memory.

Be careful when you print legal size paper that is hand fed through the LaserWriter. Even though you have followed every step of the printing setup procedure clicking "legal size" each step of the way, you might get only part of the image printing onto the paper. This is happening because the LaserWriter is a smart printer and looks to see what paper tray you have installed, and it has looked and seen the standard letter size tray and assumed (quite incorrectly) that this is what you intended (yes, even though you have checked the proper boxes). The fix is easy; go back to the Page Setup menu and look for a small box marked "Options," press the button and go to the LaserWriter Options menu (Figure 13.1). Here check "Larger Print Area

(Fewer Downloadable Fonts)" (Figure 13.2). This will free up the LaserWriter's memory, normally set aside for downloading fonts, to process the larger legal size image.

If you're getting printouts that are off center, check to see whether the paper is printing crooked (if so, the test page will have the right margin line a different distance from the right edge of the paper at the top and bottom of the page), or if the test page is displaced nearer one edge than the other.

The first problem, a skewed image, is often a paper feed problem, and you should first check how the LaserWriter works with a regular grade of photocopier paper. Sometimes a heavier or lighter grade of paper will not feed evenly. If it still prints skewed, you're in for a service call to have the laser scanner adjusted.

If the test print is moved off center evenly on the horizontal or vertical axis, then you will want to look into The LaserWriter Alignment Kit from Casey's Page Mill which, when installed, allows mechanical adjustment of the paper path relative to the toner cartridge. This may be worth it if you are creating printing masters for publishing, but, of course, letters and other simple word processing documents can simply have their margins shifted slightly to account for a LaserWriter that prints slightly off center.

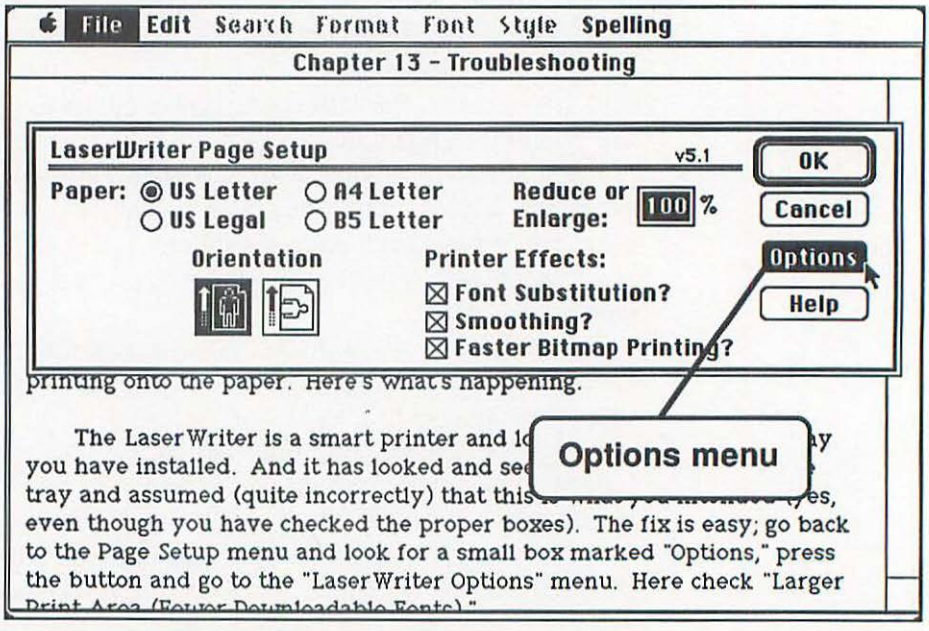


Figure 13.1. Screen image: Choosing the LaserWriter Options menu leads you into some special printing routines.

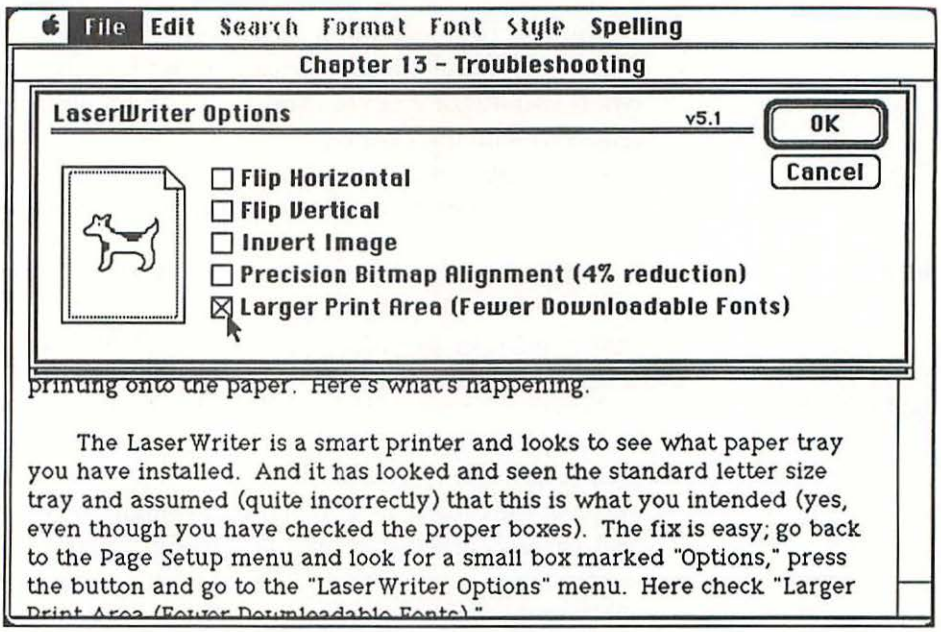


Figure 13.2. Screen image: The Options menu will solve several printing problems.

Maintaining Your LaserWriter

Apple's instruction manuals are quite thorough, but here are a few things that you might want to do that aren't mentioned or emphasized.

First, read the care and maintenence section of the LaserWriter manual carefully. You have an expensive piece of equipment, and it makes sense to take a few precautions to keep it running well.

Second, *do* the maintenence. Too many people don't ever clean the poor thing, and then they wonder why print quality falls or paper begins to jam. If you're using the printer often, or if you have three or more people using it regularly, clean it at least once each week.

When you clean the LaserWriter, take out the toner cartridge and rock it back and forth gently a few times to redistribute the toner powder. We have said this before, but it needs to be done to get the best out of your LaserWriter. You should also clean off the caked build-up on the felt of the fuser roller cleaner with a soft brush.

Once every six months, you should also clean out the air filter, which is located directly above the toner cartridge and is held in place by a small screw. Remove the screw and air filter, and then gently brush off the filter before replacing it in the printer.

Your problem can often be solved by replacing the toner cartridge with a fresh one. Please, please, please also replace the fuser roller cleaner felt pad when you install a new cartridge. It's an integral part of things and must be renewed with the cartridge.

Let's hope that nothing really serious ever goes wrong, but if it does, here are some further things that you can do before you call for a service check.

No Power

Look first to see that the printer is plugged into a working AC outlet, that the other end of the power cord is plugged into the LaserWriter, and that the printer is firmly closed. If it still doesn't come on, you're in for a service call.

Nothing Prints

Is the correct protocol (AppleTalk, baud rate, etc.) properly set on the back of the printer? Also check to make certain that the computer is working properly, and that AppleTalk is shown as "connected" in the Control Panel and that the proper LaserWriter is chosen in the Chooser. Are the LaserWriter and LaserPrep software installed in the System file? Is your spooler set to queue for future printing? This could be storing your print jobs instead of sending them through.

Readjust all the AppleTalk connectors to make certain they are electrically connected.

If you are using a LaserWriter or LaserWriter Plus and find that the printer resets in the middle of processing your document, you may have overloaded the memory. Either you are using too many downloaded fonts or you have too many style changes in a downloaded font. Try changing your document after you have found the offending page.

Sometimes you can get a message saying "(Application) cannot print this document." If so, check to see if you have selected the LaserWriter by name in the Chooser. If that's the case, then turn off "Faster bitmap printing" in the Page Setup menu.

Light Image

This is, perhaps, the most common problem with the LaserWriters. Since there are several possibilities to improve the print density, be sure to try them all.

Check the print density dial and the toner level indicator and run a standard 16–21 pound photocopier paper through to see if the image improves. (There have been cases on the LaserWriter or LaserWriter Plus where the little green-to-red indicator fails and stays green forever. If you've been using your LaserWriter for a while and the green indicator hasn't moved at all, it has happened to you.) If so, it's a paper problem, and you'll have to start using the recommended kind of paper.

Also try cleaning the corona wire as described in your operating manual, rock the toner cartridge back and forth, and then set the darkness adjustment to the darkest level for a while. Try running twenty or thirty pages of an all-black page that you've created in MacPaint or in another graphic program.

If none of these solutions work, call for service. A technician may need to adjust the amount of electrical charge that is placed on the imaging drum so there's enough charge to attract the toner powder.

Dark Image

Check the print density dial and move it to a lighter setting to see what happens. If nothing does, you should have a service call.

No Image

If the toner cartridge is old, put in a new one. If it's new, make sure you have removed the sealing tape from the toner cartridge. If you have, then try turning the printer off and on again. If the test page is still blank, a service call is in order.

Black Image

Try a new toner cartridge. If it works fine, the corona wire in the old one has broken, and that toner cartridge should be discarded. If the new one still prints black, call for service.

Scrambled Image

If garbage prints out, there's nothing you can do on your own. Call service.

Stains on the Paper

Before calling for service, give your LaserWriter a good, thorough cleaning. If that doesn't help, then it's time for a service call.

Dark Vertical Lines

First, clean the fuser roller cleaner felt with a brush. If that doesn't help, turn the printer off in the middle of printing a page, open the upper half of the printer, remove the toner cartridge, and, as quickly as possible and in the dimmest possible light, open the protective shield on the bottom of the cartridge and look for a vertical line or scratch on the drum. If a line is present, install a new cartridge.

Dark Horizontal Lines

Unfortunately, you probably have a problem with the laser itself and should call for service.

Stains on Back of Paper

Clean the fuser roller felt, wipe the underside of the toner cartridge with a damp cloth, and give the insides a good general cleaning.

Vertical or Horizontal Fogged Stripes

Clean the corona wire in the toner cartridge with the small foam pad supplied for that purpose. If that doesn't help, install a new cartridge.

Thin Vertical Lines or Stripes

Remove the toner cartridge and gently rock back and forth, and then clean the corona wire. If that doesn't help, clean or replace the fuser roller cleaner felt. If the problem persists, try another cartridge. Failing that, call for service.

Words at Margins Don't Print

You have probably created your document using the ImageWriter Page Setup and then printed it on the LaserWriter. Try changing the Page Setup Option Menu to the LaserWriter format and print again. If that doesn't work, then ad-

just the margins inward, or check the Larger Print Area on the LaserWriter Page Setup menu.

Only Half the Page Prints

There are a couple of things to check when this happens. First, are you using the legal-size paper cassette to feed letter-size paper? Don't. Change it to the proper cassette, and then it will print correctly. If that isn't it, check the Page Setup menu and see if you have selected US Legal as the paper size.

Skewed Image

This is often a paper feed problem. Perhaps the paper tray is too full or the front edge of the paper is curled. Also check to see if the paper is too thick or too thin to feed properly.

Black Image Rubs Off

Check for this after making sure you have the correct paper in the paper feed tray. It should be 16–21 pound standard photocopier paper. Heavier papers often can't be heated sufficiently to set, or "fuse" the toner ink to the paper. Also check to see if the little heat sensor that rides on the fuser assembly is dirty. If so, clean it.

If you're having a spell of very low humidity, the paper may have a charge on it that neutralizes much of the charge given it by the corona wire. If you think this is the culprit, try a package of "static free" copier paper. James River is one supplier of such paper.

If it still happens, the fuser assembly or heater bulb needs to be replaced during a service call.

Printed Output Is in Wrong Order

The original LaserWriters produced their output with the printed faces up, which meant the first page ended up on the bottom and everything had to be reversed by hand. Consequently, a number of software programs—MacWrite, for example—printed the document in reverse order (last page first), so the output was collated in correct order. This solved the problem until the LaserWriter II models were introduced. Then, when you used an application that printed from the LaserWriter in reverse order, you got the wrong order coming out of the top output tray of your LaserWriter II. These newer printers stacked the output face down in proper order.

The solution is really quite simple. Just use the pull-out face-up output delivery tray when printing from an application that usually prints in reverse order.

Quits Printing Partway Through the Job

You may run across this problem when you print long files that are mainly made of text. The printing will stop partway through and give you a message that the application is unable to print the document. In effect, there's really nothing wrong. Just begin the print job again for the pages that were skipped. Everything should work fine.

"What happened?" you ask. The Mac and LaserWriter communicate back and forth, and pages that take little time to print, like those that are primarily text, reduce the amount of time that the LaserWriter can communicate with the Mac. The result is that everything gets out of synchronization and comes to a halt. Just try again on the pages that weren't printed the first time around.

Your LaserWriter should give you great service. A bit of TLC will help, and that's up to you. Please don't get so busy that you never have time to clean the printer. It's doing so much for you, please return the favor. It'll give you years of faithful service.

CHAPTER **FOURTEEN**

Other PostScript Printers

Compugraphic CG 400-PS

Diconix Dijit/PS

Digital PrintServer 40

Digital ScriptPrinter

General Computer's Business LaserPrinter

IBM 4216 Personal Pageprinter

Allied's Linotronics

NBI 908

NEC SilentWriter LC-890

QMS ColorScript 100

QMS JetScript Conversion Kit

QMS Printers

QMS PS-2700CK

Quadram QuadLaser PS

Qume ScripTEN

Tegra PCI Typesetter Controller

The Laser Connection PS Jet+

The Laser Connection PS Jet+M

TI OmniLaser 2106

TI OmniLaser 2108

TI OmniLaser 2115

TurboLaser/PS

Varityper VT600

Varityper VT600 Plus

Wang Model LCS15

There are certainly more PostScript printers on the market than just the Apple LaserWriters. Even though most of this book has specifically concerned the LaserWriter, virtually everything we have said also holds for any PostScript printer, regardless of make. Apple was the first to introduce PostScript printing to the masses and has held a commanding lead in PostScript printer sales ever since, which explains the general emphasis on their models throughout this book.

This chapter describes the other PostScript printers and imagesetters that are currently on the market. Each of these models contains a PostScript interpreter that is based on Adobe System's PostScript page description language. There are no "almost-PostScript" or "PostScript look-alikes" or "PostScript emulators" here.

It is true that several companies are striving to "clone" Adobe's creation, which is not surprising, given that it's a breakthrough product. However, it's also an extremely complex product. Cloning PostScript is proving to be a very difficult task.

What you do is up to you, but for most business users, the risk of going with an "almost-PostScript" printer is akin to a museum's purchase of an "almost Rembrandt." Who needs the risk? Sure, there's lots of talk about how Adobe is charging huge amounts of money for its PostScript controllers, but that doesn't stand up to intelligent scrutiny.

Considering everything that goes into a PostScript printer, (powerful microprocessor, lots of memory, licensed typeface designs), your LaserWriter II or AST TurboLaser PS really isn't all that expensive. Substituting a PostScript clone might save a few hundred dollars, but what if it isn't 100 percent compatible? What if your "almost-PostScript" vendor goes out of business?

Here's what Charles R. Cortright, Marketing Director at AST Research, a major laser printer manufacturer, has said about the matter in one of his company's news releases:

> As someone who has evaluated PostScript clones for over one year and decided to go with the authentic Adobe PostScript,...only Adobe's PostScript will give you the genuine, prestigious Adobe Font Library. I have not seen any clone that comes close to providing 100 percent PostScript functionality. Adobe Systems will be in business for a long time.
>
> An end-user buys a PostScript printer primarily for font quality. AST felt that going with a PostScript clone would sacrifice quality, which we chose not to do.

This is not meant to say that a PostScript clone won't ever work as well as the original, but there are two distinct parts to PostScript: the language and the typeface designs. The equivalence of the languages can be determined by extensive testing. Quality of the font design, however, is in the eye of the beholder.

That issue aside, should you buy a LaserWriter or try some other manufacturer? This is a question that each buyer must face. Before you write the check for a non-Apple PostScript printer, however, there are several things to consider seriously.

Most obvious is service. What do you do when things go wrong? There are more LaserWriters in service and more Apple dealers around than you will find for the other models. Is this really important? Here's the answer to your question: Laser printers use the same "insides" as an office photocopier. What is the piece of office equipment most prone to trouble? Believe me, you want to have help near if things go sour. Is there a dealer nearby who can repair your ailing laser printer?

Laser printers, in general, seem to be more reliable than photocopiers, but they can still go haywire. The money you might save on your printer could be need to cover the expense of shipping it off to a distant repair center and being without it for a month or so.

Less obvious is the fact that not every PostScript printer model is the same. You will see from the data shown below that there are many varieties of PostScript printers. They range from publishing powerhouses such as Digital's Printserver 40, which pumps out up to 40 pages per minute, to Texas Instrument's Omnilaser 2106, which issues 6 pages per minute.

Speed is important. Time is money in the business world. Nevertheless, quoted speeds can sometimes be misleading. For example, you'll see some makers of PostScript printers brag about how must faster their model is compared with Apple's LaserWriter, but which LaserWriter do they mean? The original one with an early (and slower) version of PostScript? There's little doubt that the first Apple LaserWriters were slower than their rated engine speed of eight pages per minute, but there's also little reason to continue to compare speeds of much newer printers with the older LaserWriters. The new LaserWriter II models are much faster than their predecessors. For example, the manuscript for this book was printed from a LaserWriter II NT in double-spaced pages of 12-point Tomes Roman which cranked out at about eight pages per minute. The new Apple printers are as fast as their competitors, so you should really be choosing your printer on a variety of other factors, and here is a checklist of features to look for:

- Does it allow manual feed? Some printers don't, which can be a serious shortcoming for many users.

- Does it print 8 1/2 by 14-inch (legal size) paper?
- Are Macintosh screen fonts included with the printer? Know ahead of time if you're going to have to pay extra for them.
- What are the consumable items and how are they replaced? The LaserWriters have a combined toner cartridge and imaging drum. You replace it as a single unit. Other printers may have you pouring toner powder from time to time to refill the toner tray. The imaging device is changed separately in these models. Are the replacements easily obtained?
- Have you compared actual printouts with LaserWriter output? Remember, some laser printers are write-white rather than write-black like the LaserWriters. This will affect the appearance of the printing, especially on narrow lines and small typesizes.
- Is it interfaced the way you want it? Not all PostScript laser printers have AppleTalk connectors, for example. Check this carefully if you think you may want to network the printer in the future.

In addition, note that the resident typefaces can vary. Those with a mix of typefaces different from the Apple printers are the Varityper VT600, the Compugraphic 400-PS, CPT PS-8, Digital's ScriptPrinter and Printserver 40, and the QMS PS-800 II and 810 models.

In your search for the "perfect fit," you will also want to consider price. Prices have not been included in the following tables because they change rapidly as the computer publishing market expands and matures. Trust, however, that higher resolution and printing speed mean higher prices.

Compugraphic CG 400-PS

Compugraphic is a well-known firm in the publishing systems field. Its 400 dot per inch printer, the 400-PS, is actually manufactured by Agfa-Gevaert, the Belgian photo and publishing equipment giant who owns a major interest in Compugraphic. It is available in Europe through Agfa-Gevaert as the P400 PS.

The 400-PS is not actually a laser printer; it uses light-emitting diodes (LEDs) rather than a laser. Laser printers use a single laser to fire the light image at the light-sensitive surface in a sweeping back and forth manner. LED printers, on the other hand, use a row of LEDs the width of the page to fire light at the surface of the light-sensitive imaging drum as it moves downward to the bottom of the page.

Is one better than the other? Not in any practical sense, although LED technology promises to be more durable as the technology matures. The only

other PostScript LED printer currently on the market is the NEC SilentWriter LC-890, an 8-page per minute, 300 dot per inch model that will be described below.

The Compugraphic 400-PS is a serious publishing printer and proofing device designed for larger publishing groups, and contains an excellent selection of typefaces.

Tables 14.1–14.4 describe the Compugraphic 400 PS, the CPT PS-8, Dataproducts LZR 1260, and Dataproducts LZR 2665, respectively.

Table 14.1 Compugraphic 400 PS

RAM	6.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68020 processor
Resolution	400 dots per inch
Fonts	Times, Helvetica (Medium, Light, Black, and Condensed), Symbol, Courier, Avant Garde Gothic, ITC Bookman, ITC Garamond, ITC Korinna, ITC Lubalin, ITC Souvenir, Letter Gothic, Park Avenue, New Century Schoolbook, Optima, Palatino, Lucida, Math Pi, and ITC American Typewriter
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	18 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	100,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	2,000 sheets
No. of paper trays	2 (second tray holds 230 sheets)
Other features	20MB hard disk for font storage
From	Compugraphic Corp., 200 Ballardville St., Wilmington, MA 01887, (617) 658-5600; (800) 822-5524

Table 14.2 CPT PS-8

RAM	2.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, ITC Avant Garde Gothic, ITC Lubalin Graph, ITC Souvenir, ITC Bookman, New Century Schoolbook
Font Types	PostScript Bezier outline, scalable

Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial
Recommended Duty Cycle	3,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	100 sheets
No. of paper trays	1
From	CPT Corp., 8100 Mitchell Rd., Box 295, Minneapolis MN 55440, (612) 937-8000

Table 14.3 Dataproducts LZR 1260

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68020 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, ITC Avant Garde Gothic, ITC Bookman, Palatino, New Century Schoolbook, Zapf Chancery, Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	12 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	10,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	1
Other Features	Two additional paper cassettes available
From	Dataproducts Corp., 6200 Canoga Ave., Woodland Hills, CA 91365, (818) 887-8000

Table 14.4 Dataproducts LZR 2665

RAM	2.5 megabytes
ROM	0.5 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable

Printer protocols	PostScript, Diablo
Printing speed, max.	26 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	80,000 pages per month
Maximum paper size	11 x 17 inches
Paper bin capacity	750 sheets total
No. of paper trays	2
Other features	Optional 1500-sheet feeder
From	Dataproducts Corp., 6200 Canoga Ave., Woodland Hills, CA 91365, (818) 887-8000

Diconix Dijit/PS

The Dijit/PS isn't a laser printer or an LED printer; it's an ink-jet printer. Just as the name implies, the Dijit sprays ink at the paper, which sounds messy, but it's actually a very carefully controlled process that yields handsome results.

The Dijit/PS is a 300 dot per inch ink-jet printer and is designed for turning out lots of printing. The complete specifications were not available at the time of publication but the ones that were set prior to publication, are shown in Table 14.5.

Table 14.5 Dijit/PS

RAM	4.0 megabytes
ROM	1.0 megabyte
Controller	?
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo
Printing speed, max.	20 pages/min.
Interfaces	?
Recommended Duty Cycle	70,000 pages per month
Maximum paper size	? inches
Paper bin capacity	? sheets
No. of paper trays	?
From	Diconix, Inc., 3100 Research Blvd., Dayton, OH 45420, (513) 259-3100

Digital PrintServer 40

Looking at the specs for Digital's PrintServer 40 (see Table 14.6), you would think that such speed and power costs a lot of money. It does. This one is designed for heavy use among a lot of users.

Table 14.6 Digital PrintServer 40

RAM	5.0 megabytes
ROM	0.256 megabyte
Controller	Micro VAX II
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol, ITC Avant Garde Gothic, ITC Lubalin Graph, ITC Souvenir, New Century Schoolbook
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LN03
Printing speed, max.	40 pages/min.
Interfaces	DECNet
Recommended Duty Cycle	100,000 pages per month
Maximum paper size	11 x 17 inches
Paper bin capacity	2,500 sheets total
No. of paper trays	3
From	Digital Equipment Corp., 129 Parker St., Maynard, MA 01754, (617) 897-5111

Digital ScriptPrinter

This Digital model is a bit more down-to-earth as far as price (well under $10,000) is concerned. Note that Digital has not included an AppleTalk interface. If you currently own one of Digital's LN03 laser printers, there is a PostScript upgrade that can be installed to convert it to the ScriptPrinter configuration. The specifications for the Digital ScriptPrinter are shown in Table 14.7.

Table 14.7 Digital ScriptPrinter

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	Unspecified
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol, ITC Avant Garde Gothic, ITC Lubalin Graph, ITC Souvenir, New Century Schoolbook

Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	8 pages/min.
Interfaces	serial
Recommended Duty Cycle	10,000 pages per month
Maximum paper size	8 1/2 x 11 inches
Paper bin capacity	250 sheets
No. of paper trays	1
From	Digital Equipment Corp., 129 Parker St., Maynard, MA 01754, (617) 897-5111

General Computer's Business LaserPrinter

This 6-page per minute PostScript printer is built around the same basic low cost printer engine that is used in General Computer's QuickDraw-based Personal Laser Printer.

It comes with 2 megabytes of RAM, expandable to 3 megabytes, and can be shared via AppleTalk. An additional typeface, Helvetica Condensed, is included.

Table 14.8 General Computer's Business Laser Printer

RAM	2.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Helvetica Condensed, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo
Printing speed, max.	6 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	3,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	150 sheets
No. of paper trays	1
From	General Computer, 580 Winter St., Waltham, MA 02154, (617) 890-0880

IBM 4216 Personal Pageprinter

Although Apple is often accused of taking its own single-minded approach to things, IBM must be awarded the "do it differently" prize for its version of PostScript printing. Some of its approaches do sound good, but let's take a closer look.

First, IBM uses a high-speed video interface to transfer data to the printer, which sounds good. Then, it keeps PostScript in software form so it can be easily upgraded to newer versions, which also sounds good. Now, what does it all mean?

The video interface is high-speed 1.8 megabits per second. However there are two things wrong here. One is found in the printer's name, personal. This is a single-user printer. The printer's "brains" are on a card that fits into a slot in your PC. Of course, that takes away a slot, but so would an Apple or Tangent PC Card that would interface a PC with an Apple LaserWriter. Either way, you use up a precious slot.

IBM's Personal Pageprinter costs more than a LaserWriter II NT, yet only serves one user. For less money, you can have a LaserWriter II NT that can serve thirty PCs. If you're in business to make a profit, that's a key consideration.

The high data transfer speed of the IBM printer seems impressive on first glance. Let's look at what data is being transferred. In the Apple's design (and, indeed, in virtually all the others as well), the data that gets sent to the printer is PostScript, and we know that for text and object-oriented graphics, PostScript is fairly economical. Then, inside the LaserWriter, the PostScript interpreter converts all the PostScript code into a raster scan of bit-mapped data that is used to "paint" the image.

IBM's approach is different. The PostScript data gets converted to the bit-mapped image *inside* the PC. This means that everything—text and graphics—is all converted into bit maps and then sent to the printing device, which is a lot of data. That's every single dot that makes the characters on an all-text page. Consequently, speed isn't always what it seems, and remember, you're giving up the ability to hook more than one computer to the printer.

The second advantage to the IBM Personal Pageprinter is that you can upgrade the version of PostScript as newer ones become available, which is probably a plus, or so, but there's a downside here, too. You'll sit for an extra two minutes every time you boot up while PostScript loads into the interpreter.

Getting everything crammed onto an add-in card is an exceptional task, and IBM didn't succeed. There are several things left off that they expect you to deal with when and if you want to use their PostScript printer. We've already mentioned that PostScript itself is software-based and must be loaded each time the system is powered-on. The same is true for most of the fonts.

Only Courier, Times, Helvetica, and Symbol are installed in ROM and are thus always available. The rest must be downloaded from the PC's hard disk when you want to use them. IBM supplies a utility program so you can do this.

PostScript is a computer language that can be used with virtually any device that is PostScript-compatible, which is one of its great advantages. IBM's PostScript printer, however, isn't generally compatible with other computers or software. This means that your software must have a specific Pageprinter driver for it to work. A LaserWriter driver won't do, nor will a standard PostScript printer driver, nor the standard DOS print commands. For instance, when you print from DOS, you get a text printout of the PostScript code.

What you buy is up to you, but there's no comparison between Apple's well conceived LaserWriter and IBM's poorly implemented Personal Pageprinter. Buy a LaserWriter and use it to make an IBM label to paste over Apple's logo if it bothers you. You'll be glad you did. (The specifications for IBM's 4216 Personal Pageprinter are given in Table 14.9.)

Table 14.9 IBM Personal Pageprinter

RAM	2.5 megabytes (2.0 MB are useable, 0.5 MB is reserved to hold PostScript code)
ROM	not specified
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol. (Helvetica Narrow, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, and ITC Zapf Dingbats are supplied as software and must be downloaded for use.)
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, IBM ProPrinter XL
Printing speed, max.	6 pages/min.
Interfaces	proprietary video
Recommended Duty Cycle	Not specified
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	150 sheets
No. of paper trays	1
From	IBM Corp., Old Orchard Rd., Armonk, NY 10504, (800) 447-4700

Allied's Linotronics

In the "real world" of typesetting, there are two Linotronic models that are very popular. A third model is slated for introduction in early 1989. It will be based on LED, rather than laser technology. The specifications for Allied's

Linotronic 100P and 300P Laser Imagesetters are given in Tables 14.10 and 14.11, respectively.

Table 14.10 Linotronic 100P Laser Imagesetter

RAM	3.0 megabytes
ROM	0.64 megabytes
Controller	32-bit Motorola 68020 processor
Resolution	1,270, 635 and 317 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	Not specified
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	Not specified
Maximum Image Area	11.7 inches x 25.7 inches at 1270 dpi
Input cassette	196 feet x 12 inches
Output cassette	15 feet x 12 inches
Other features	Comes with 20MB hard disk for font storage. An 80MB hard disk is optional.
From	Allied Linotype, 425 Oser Ave., Hauppauge, NY 11788, (516) 434-2000

Table 14.11 Linotronic 300P Imagesetter

RAM	6.0 megabytes
ROM	0.64 megabytes
Controller	32-bit Motorola 68020 processor
Resolution	2,540, 1,270 and 635 lines per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	Not specified
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	Not specified
Maximum Image Area	11.7 inches x 25.8 inches at 2,540 dpi
Input cassette	196 feet x 12 inches
Output cassette	98 feet x 12 inches
Other features	Comes with 80MB hard disk for font storage.
From	Allied Linotype, 425 Oser Ave., Hauppauge, NY 11788, (516) 434-2000

NBI 908

NBI's PostScript printer has a design different than the others. For example, it has a computer interface that is proprietary and is designed for NBI systems. It operates at a speed approximately four times that of LocalTalk. There is also no built-in ROM containing the PostScript interpreter or fonts. These are downloaded from the host computer. Specifications for the NBI 908 are shown in Table 14.12.

Table 14.12 NBI 908

RAM	2.5 megabytes
ROM	none
Controller	32-bit 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	8 pages/min.
Interfaces	NBI Peripheral Connection
Recommended Duty Cycle	5,000 pages per month
Maximum paper size	8 1/2 x 11 inches
Paper bin capacity	250 sheets
No. of paper trays	1
From	NBI Inc., Box 9001, Boulder, CO 80301, (800) 922-8828, Ext. 300, (303) 938-2825

NEC SilentWriter LC-890

NEC's PostScript printer isn't a laser printer; it uses LED technology that we described in the section on the Compugraphic CG-400PS. The output quality is as good as that of the Apple LaserWriters, so don't pass by the NEC printer just because it's technology is a bit different. Its specifications are given in Table 14.13.

Table 14.13 NEC SilentWriter LC-890

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	32-bit 80186 processor
Resolution	300 dots per inch

Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo, LaserJet+
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	3,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	2
From	NEC Information Systems, Inc., 155 Swanson Road, Boxborough, MA 01719-9988, (617) 635-4400

QMS ColorScript 100

This is the first color PostScript printer, and it's based on the Mitsubishi G650 color thermal transfer print engine. Thermal printers heat a wax-based inked film ribbon which, when pressed on the paper, transfers the heated dots of ink to the paper. Color software such as Abobe's Illustrator and Quark Xpress prints in full color. The cost of the ColorScript printer is high but it's unique. Table 14.14 provides its specifications.

Table 14.14 QMS ColorScript 100

RAM	8.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68020 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	Depends of size of page and colors used. Three-color, letter-sized pages will print at 1 page per minute. Three-color pages 11 inches x 17 inches print in 1.75 minutes.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	4,000 pages per month
Maximum paper size	11 x 17 inches
Paper bin capacity	150 sheets

No. of paper trays	1
Other features	Can print in one-, three- or four-color mode. Has built-in 20MB hard disk and has a SCSI interface for adding additional storage devices.
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300

QMS JetScript Conversion Kit

This kit, when installed in your IBM-PC's slot, interfaces with a video adapter card installed in a HP LaserJet+. The PC-resident controller card does not contain PostScript in permanent ROM memory chips. PostScript comes as software to be installed on your hard disk for automatic loading every time the PC is turned on. It is a similar arrangement to IBM's Personal PagePrinter.

Is this the answer if you already have a LaserJet+, but you want to start using the power of PostScript? As with most things, it depends. First, the JetScript isn't cheap. Second, it to can't be shared among multiple users, which makes it expensive for more than a one-person show. Nevertheless, the version of PostScript can be upgraded easily because it's software.

Note also that the JetScript board is available through Hewlett-Packard and their dealers. Its specifications are shown in Table 14.15.

Table 14.15 QMS JetScript Conversion Kit

RAM	3.0 megabytes (2.0 MB are useable, 1.0 is reserved for PostScript code)
ROM	not applicable
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	8 pages/min.
Interfaces	proprietary video
Recommended Duty Cycle	same as LaserJet+
Maximum paper size	same as LaserJet+
Paper bin capacity	same as LaserJet+
No. of paper trays	same as LaserJet+
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300. Also available from Hewlett-Packard offices and dealers.

QMS Printers

QMS is a major manufacturer of PostScript laser printers and produces models running from the 8-page per minute PS-800 II and PS-810 to the 25-page per minute PS-2400. The specifications for the QMS PS-800 II, PS-810, PS-1500, and PS-2400 models are shown in Tables 14.16, 14.17, 14.18 and 14.19, respectively.

Table 14.16 QMS PS-800 II

RAM	2.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo, LaserJet+, HPGL
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	10,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	2
Other features	RAM expandable to 3MB. Selectable face-up or face-down paper output.
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300 or from The Laser Connection, Box 850296, Mobile, AL 36685, (800) 523-2696

Table 14.17 QMS PS-810

RAM	2.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats.
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	8 pages/min.

Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	5,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	200 sheets
No. of paper trays	1
Other features	RAM expandable to 3MB
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300 or from The Laser Connection, Box 850296, Mobile, AL 36685, (800) 523-2696

Table 14.18 QMS PS-1500

RAM	4.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68020 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	15 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	15,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	2
Other features	Has SCSI interface for hard disk
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300 or from The Laser Connection, Box 850296, Mobile, AL 36685, (800) 523-2696

Table 14.19 QMS PS-2400

RAM	2.5 megabytes
ROM	0.5 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol

Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	24 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	30,000 pages per month
Maximum paper size	11 x 17 inches
Paper bin capacity	2,000 sheets total
No. of paper trays	3
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300

QMS PS-2700CK Conversion Kit

If you already have a Xerox 2700 laser printer, the QMS PS-2700CK will convert it into full PostScript compatibility. The specifications of this kit are shown in Table 14.20.

Table 14.20 QMS PS-2700CK Conversion Kit

RAM	2.5 megabytes
ROM	0.5 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Xerox native mode, Diablo
Printing speed, max.	not applicable
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	not applicable
Maximum paper size	not applicable
Paper bin capacity	not applicable
No. of paper trays	not applicable
From	QMS Inc., 1 Magnum Pass, Mobile, AL 36618, (800) 631-2692, (205) 633-4300

Quadram QuadLaser PS

Quadram has fitted one of its laser printers with a PostScript controller. This model's specifications are shown in Table 14.21.

Table 14.21 QuadLaser PostScript

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	10,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	1
Other features	SCSI hard disk interface
From	Quadram, 1 Quad Way, Norcross, GA 30093, (404) 923-6666

Qume ScripTEN

Note that the ScripTEN lacks a manual feed feature, so that if you plan to do envelopes or special stock, this might not be the printer for you. Table 14.22 lists its specifications.

Table 14.22 Qume ScripTEN

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+
Printing speed, max.	10 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	5,000 pages per month
Maximum paper size	8 1/2 x 14 inches

Paper bin capacity	250 sheets
No. of paper trays	1
From	Alcatel Qume, 2350 Qume Dr., San Jose, CA 95131, (800) LASER-55; (408) 432-4000

Tegra PCI Typesetter Controller

At the time of publication, Tegra was introducing PostScript for its line of typesetters. The controller has AppleTalk and RS-232C interfaces. Please contact Tegra for up-to-date specifications. (Tegra Inc., Middlesex Technology Center, 900 Middlesex Turnpike, Billerica, MA 01821, [617] 663-7435.)

The Laser Connection PS Jet+

This is an add-in board that converts a LaserJet or other Canon CX-based laser printer into a PostScript machine. Its specifications are detailed in Table 14.23.

Table 14.23 PS Jet+

RAM	2.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial
Recommended Duty Cycle	same as LaserJet+
Maximum paper size	same as LaserJet+
Paper bin capacity	same as LaserJet+
No. of paper trays	same as LaserJet+
Other features	Memory can be expanded to 3MB.
From	The Laser Connection, Box 850296, Mobile, AL 36685, (800) 523-2696

The Laser Connection PS Jet+M

If you plan on doing lots of bit-mapped graphics and downloaded fonts, this conversion kit will handle it with its larger memory. See table 14.24 for its specifications.

Table 14.24 PS Jet+M

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats.
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, LaserJet+, HPGL, Diablo
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial
Recommended Duty Cycle	same as LaserJet+
Maximum paper size	same as LaserJet+
Paper bin capacity	same as LaserJet+
No. of paper trays	same as LaserJet+
From	The Laser Connection, Box 850296, Mobile, AL 36685, (800) 523-2696

TI OmniLaser 2106

This 6-page per minute printer is built around the same basic low-cost printer engine that is used in General Computer's Personal Laser Printer and Okidata's LaserLine 6. Table 14.25 contains its specifications.

Table 14.25 TI OmniLaser 2106

RAM	2.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats

Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo, Epson, HPGL, LaserJet+
Printing speed, max.	6 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	3,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	150 sheets
No. of paper trays	1
Other features	One cartridge slot. Font cartridges are available.
From	Texas Instruments Inc., Box 809063, Dallas, TX 75380-9063, (800) 527-3500

TI OmniLaser 2108

The Omnilaser 2108 is restricted to letter-sized sheets and lacks a manual feed feature. Its specifications are given in Table 14.26.

Table 14.26 TI OmniLaser 2108

RAM	2.0 megabytes
ROM	0.576 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo, Epson, HPGL, LaserJet+, Qume
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	10,000 pages per month
Maximum paper size	8 1/2 x 11 inches
Paper bin capacity	250 sheets
No. of paper trays	1
Other Features	Two cartridge slots. Font cartridges available.
From	Texas Instruments Inc., Box 809063, Dallas, TX 75380-9063, (800) 527-3500

TI OmniLaser 2115

Texas Instruments also offers a 15-page per minute PostScript laser printer but it is an early version that has only four typefaces. The specifications for the OmniLaser 2115 are detailed in Table 14.27.

Table 14.27 TI OmniLaser 2115

RAM	3.0 megabytes
ROM	0.576 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo, Epson, HPGL, LaserJet+, Qume
Printing speed, max.	15 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	25,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	2
Other features	Optional IBM Proprinter emulation available. Two cartridge slots. Font cartridges available.
From	Texas Instruments Inc., Box 809063, Dallas, TX 75380-9063, (800) 527-3500

TurboLaser/PS

AST's PostScript entry, the TurboLaser/PS, offers a lot of value. It is priced lower than Apple's printer, but it lacks a manual-feed mechanism and is restricted to paper no larger than letter-sized. Table 14.28 provides its specifications.

Table 14.28 TurboLaser/PS

RAM	3.0 megabytes
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	8 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	5,000 pages per month

Maximum paper size	8 1/2 x 11 inches
Paper bin capacity	250 sheets
No. of paper trays	1
Other features	LaserJet+ and Diablo emulation can be added at extra cost.
From	AST Research Inc., 2121 Alton Ave., Irvine, CA 92714, (714) 553-0340

Varityper VT600

Varityper is a familiar name in the printing and typesetting equipment business. As might be expected, this company has entered the PostScript arena with a laser printer/typesetter that is designed especially for publishing. It's no ordinary laser printer. For example, it has a significantly higher printing quality than the usual PostScript laser printer. With a resolution of 600 dots per inch and a finer particle toner that can take advantage of the increased dot density, this printer is really a plain paper typesetter. However, you pay for the increased resolution. With four times the dot density, you pay about four times the price of a LaserWriter II NT. Its next closest competitor, Allied's Linotronic 100, costs about twice what the Varityper does.

Note that the VT600 contains Varityper's version of the Times Roman and Helvetica designs, called Varitimes and Aristocrat. You won't be able to print Times or Helvetica from the VT600 unless you have a downloadable version of the typefaces from Adobe.

This printer has several other noteworthy features. For example, the paper feed belt has vacuum control to improve the paper registration, and its straight paper path makes it easier to use heavier weights of paper, even light card stock.

This machine is not an office printer. It is a low-end typesetter and, with its super-fine toner and high quality selenium imaging drum, a maintenance-intensive machine. It is a good alternative to a Linotronic 100, however, especially if the 600 dots per inch resolution is suitable for your routine uses.

The Varityper VT 600 has the specifications shown in Table 14.29.

Table 14.29 Varityper VT 600

RAM	6.0 megabytes
ROM	0.64 megabyte
Controller	32-bit Motorola 68020 processor
Resolution	600 dots per inch
Fonts	Varitimes, Aristocrat, Courier, Symbol
Font Types	PostScript Bezier outline, scalable

Printer protocols	PostScript
Printing speed, max.	10 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	3,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	200 sheets
No. of paper trays	1
Other features	Built-in 20 MB hard disk.
From	Varityper, 11 Mount Pleasant Ave., East Hanover, NJ 07936, (800) 631-8134

Varityper VT 600 Plus

For about a thousand dollars more than the VT 600, you can have the entire Adobe typeface series that you get with the LaserWriter II NT and NTX. Otherwise, this model, whose specifications are shown in Table 14.30, is virtually identical to the VT 600.

Table 14.30 Varityper VT 600 Plus

RAM	6.0 megabytes
ROM	0.64 megabyte
Controller	32-bit Motorola 68020 processor
Resolution	600 dots per inch
Fonts	Varitimes, Aristocrat, Courier, Symbol, Times, Helvetica, Helvetica Narrow, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	10 pages/min.
Interfaces	AppleTalk, serial, parallel
Recommended Duty Cycle	3,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	200 sheets
No. of paper trays	1
Other features	Built-in 20 MB hard disk.
From	Varityper, 11 Mount Pleasant Ave., East Hanover, NJ 07936, (800) 631-8134

Wang Model LCS15 Printer

If you have a Wang system networked in your office, you can have PostScript, too. Note, however, that there is no provision for AppleTalk. This model is available for connection to Wang networks or in configuration for serial and parallel data. Its specifications are described in Table 14.31.

Table 14.31 Wang Model LCS15 Printer

RAM	Not specified
ROM	Not specified
Controller	Not specified
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript
Printing speed, max.	15 pages/min.
Interfaces	Wang Data Link or serial and parallel
Recommended Duty Cycle	25,000 pages per month
Maximum paper size	8 1/2 x 14 inches
Paper bin capacity	250 sheets
No. of paper trays	2
From	Wang, One Industrial Avenue, Lowell, MA 01851, (800) TEL-WANG, (617) 459-5000

CHAPTER **FIFTEEN**

The Future of the LaserWriters

PostScript Matures

Apple's Future in Printers

What about QuickDraw?

Adding It All Together

We've discussed the past and present line of LaserWriters at some length, and it seems appropriate to end with a look at the future of the LaserWriters and of PostScript printing in general. Let me first insert a small caveat to hide behind as the future unfolds.

I am simply an observer of the industry; I'm not employed in a development lab somewhere tinkering away on the future of printing technology. I am a qualified observer, however, and I expect that much of what this chapter forecasts will come to fruition in one way or another.

In my opinion we are in for a lot of developments in the next five years, both in the computers that we use and in the printers that produce the output. You're in for a lot of "fun and function," and if price isn't too great a factor, you'll be able to expect magnificent printing from your system.

Let's take a look at the future step by step, starting with PostScript.

PostScript Matures

There's little question today that PostScript has become the industry standard for describing pages of graphic and typographic elements. Independent of the resolution of the final printing device, PostScript is portable. It doesn't care about the technology used for the printing; it just uses what's there.

However, PostScript is being cloned by a number of firms. You will see functioning "PostScript-compatible" printers coming onto the market within the next few years. You will probably also read about quirks in these new PostScript clones. Some complex routines probably won't work quite as well as they do with Adobe's PostScript.

The variety of PostScript output devices will increase. You'll see a number of major typesetting machines, such as Tegra and Itek, use PostScript. More and more typefaces will be converted into PostScript.

Color will reach the PostScript output world. Color film makers will produce 35mm slides directly from Mac or IBM files. Of course, one will proof them first in black and white on the LaserWriter. Look for color PostScript printers using laser, thermal transfer, and inkjet technology. Some of these will be producing very nice output at 300 dots per inch or more. Color laser printers will be expensive; they require three or four individual photosensitive imaging and toner drums to produce color output. Thermal and inkjet technologies are cheaper, and you'll see some fairly reasonable PostScript and QuickDraw color printers based on them.

You'll also see almost every software package support PostScript output. There will be some hybrid programs, incorporating a fair amount of page layout and graphics input along with strong word processing functions. FullWrite Professional from Ashton-Tate has already entered this ground. Look for more to follow.

Adobe Systems will continue to develop PostScript language in two directions: added functionality and greater speed. This company has already made great progress in speed, but the next few years should quicken PostScript even more, especially on high resolution machines. Look, too, for the introduction of faster microprocessor chips for processing the PostScript image.

You've probably heard of display PostScript (DPS). This is a form of PostScript that drives the screen display so software can use the same commands to produce both the displayed image and the printed image while simultaneously being independent of the screen and printer resolution. At present, DPS is somewhat slow. Any early Mac user will remember what slow screen redrawing can be like. In truth, QuickDraw, as Apple presently uses it, is pretty fast, and Apple owns it. You'd want to control your own destiny, too, if you owned a company the size and strength of Apple. Thus, you probably won't be seeing DPS images on your Mac's screen, unless you purchase such capability as software or hardware separately from Adobe to run with certain programs. However, that's a possibility only of the future.

Apple initiated the move to PostScript with its adoption of PostScript as the basis for the LaserWriters. Once again, Apple started an industry trend, and now you're part of it.

Apple's Future in Printers

As a computer manufacturer, Apple has always paid more attention to the printer end of things than any other personal computer manufacturer, and it has led the move to graphics; even the venerable Apple II could do more with graphics than most computers.

As a result, Apple has produced printers that handle graphics and become the leading desktop publishing printer manufacturer. Don't look for Apple to falter in its lead. The introduction of the LaserWriter II series in early 1988 showed a finely tuned awareness of the marketplace and a good eye for the future. Apple will maintain a very strong position in PostScript output hardware for many years.

Note that I haven't used the term *laser printers*. This is because there's some uncertainty about this technology for the future. Lasers have done the job quite well, with a fair degree of dependability, but they require a costly and sensitive optical system to focus the light and move it back and forth

across the page. This means money, which adds to the cost of the laser printer.

There is a newer technology called the light-emitting diode or LED, that also gives a highly controlled point source of light. This technology consists of tiny, solid state devices that can be placed in a row, and whose light is brought together through fiber optics. A row of LEDs can sweep down the page, blinking on and off to form the 300 dot per inch image on a photosensitive cartridge, similar to the way in which the current LaserWriter works. Few, if any costly lenses or mirrors are needed, and the LED system is more resistant to shock.

Consequently, LED technology will probably play a role in Apple's future. Indeed, in a few years, Apple may not even make printers containing lasers. We may have to begin calling them page printers.

Inkjet technology is also improving. Hewlett-Packard is building one with the same resolution as its LaserJet printers which is selling for under $1,000. It seems likely that others will develop inkjet technology to this degree, and that Apple will take a close look at using it. These printers will be small, lightweight, and quiet, and they could even be produced for color printing.

What about a simple increase in the resolution of current laser printers? One might think that that's the next step, and it could be, but it's probably not. Here's why.

As you go from 300 dots per inch to 400 dots per inch, the needed memory goes up dramatically because the resolution is multiplied, not added, when the image is made. The mathematics is simple: $300 \times 300 = 90{,}000$ dots per square inch; $400 \times 400 = 160{,}000$ dots per square inch—almost 80 percent greater. You have to store all this information before printing. Increasing the resolution 25 percent thus means an 80 percent increase in the required memory chips. The price of memory chips has been falling as the years go by, but they still add a considerable cost.

Remember, too, that all the data has to be sent to the printer. The time for sending all this data will drop in the future as AppleTalk transmission rates rise. It's probable that they will double or triple by 1989 or 1990. Single users may not care much, but larger networked work groups will benefit considerably. At one megabit per second, AppleTalk makes a very competitive small local area network scheme.

What about QuickDraw?

Apple did a smart thing when it developed QuickDraw: it enabled the Mac to have its crisp monitor display using graphics that didn't take all day to produce on the screen. QuickDraw is a valuable shortcut and one that is also very powerful. Apple didn't set out to produce a page description language, but in some ways it produced the crude equivalent of one.

QuickDraw is able to scale and manipulate objects, and if its capabilities are expanded, it could become a decent page description language in its own right. A look at the output from the LaserWriter II SC or General Computer's Personal LaserPrinter will show you just how much QuickDraw can do right now. You'll see several more manufacturers introduce QuickDraw-based laser printers in the future. You can bet there will be a scheme for including them with their big cousins in AppleTalk networks.

QuickDraw can be enhanced to scale outline typefaces, but taking it the step into resolution-independence will be a rather long process. Indeed, it may not ever happen, but for producing the screen image and for printing from a 300 dots per inch laser (or other) printer, QuickDraw can be quite sufficient. It seems fairly certain that you'll see further enhancements.

Adding It All Together

PostScript is a "glue" that binds computer applications and printed output together. There's little question that from now on PostScript will make a difference in what you can do with your computer. Today's LaserWriters are an important part of the present scene and will continue to play a major role in the production of high quality documents.

PostScript printers will be a major part of Apple's computer strategy for many years to come. They may not be laser printers, however. PostScript can be used to produce images from virtually any kind of printing technology, be it liquid crystal shutter, ion deposition, LED, or microencapsulated dye transfer technology. Your wise use of PostScript today assures that you will be using tomorrow's technology as well.

Does all this mean that you shouldn't be buying one of today's LaserWriters? Certainly don't wait if you have a need for high quality printed output, especially if your interest is desktop publishing or presentations. The LaserWriters are excellent products and are quite reliable. The technology does indeed promise to improve in the future, but don't deny yourself today's technology by waiting for tomorrow's to come. Jump in now and marvel at the power of PostScript printing. You're finally in control of the total appearance of your work. Things will never quite be the same.

APPENDIX **A**

The LaserWriter Specifications

Currently, there are five LaserWriters that have been marketed by Apple Computer. Four are PostScript models and one is based on Apple's own QuickDraw graphics routines. Each model is based on a working laser print engine manufactured by Canon. The earlier LaserWriters were based on the Canon LBP-CX engine, the same one that Hewlett-Packard used in its original LaserJets.

The current engine has been totally redesigned into a lighter, more compact unit which serves as the basis for Apple's new LaserWriter II models and Hewlett-Packard's LaserJet II series. Both Canon engines, the original CX and the newer SX, are nominally rated at 8 pages per minute, but, in truth, the controller hardware (the part that Apple and Hewlett-Packard add to make it all work) sets the speed depending on the images sent to the printer. More bit-mapped graphics mean slower printing. The following table provides the principal specifications of the LaserWriters that will be described in greater detail in the rest of this appendix.

Product	*RAM, MB*	*ROM, MB*	*No. of Typefaces*	*Laser engine model*
LaserWriter	1.5	0.5	4	Canon LBP-CX
LaserWriter Plus	1.5	1.0	11	Canon LBP-CX
LaserWriter II SC	1.0	0.032	4	Canon LBP-SX
LaserWriter II NT	2.0	1.0	11	Canon LBP-SX
LaserWriter II NTX	2.0	1.0	11	Canon LBP-SX

The Apple LaserWriter

In early 1985, Apple brought out its first laser printer; a networkable one based on the newly developed PostScript page description language. Its introduction brought PostScript into the world of laser printing.

The original LaserWriter has the following specifications:

RAM	1.5 megabyte
ROM	0.5 megabyte
Controller	32-bit Motorola 68000 processor at 11.16 megahertz
Resolution	300 dots per inch
Fonts	Times, Helvetica, Courier, Symbol
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo 630
Printing speed, max.	8 pages/min.
Interfaces	Two serial ports (one D25 for RS-232C, one D9 for RS-422 and AppleTalk)
Recommended Duty Cycle	Less than 4,000 pages per month
Recommended paper	16–21 pound single sheet photocopy bond. 8–34 pound letterhead and colored stock. Standard weight transparency stock.
Paper sizes	Letter, legal, A4, and B5 sizes.
Paper bin capacity	100 sheets
Max. printable area	US letter—8.0 by 10.78 inches. Legal—6.75 by 12.84 inches. A4—7.41 by 10.86 inches. B5—7.69 by 10.16 inches.
Output tray capacity	20 sheets face up
Operating noise	50 db max at bystander position during standby and 60 db during printing.
Power consumption	Standby—170 watts average. Printing—900 watts maximum.
Dimensions	11.5 high by 18.5 wide by 16.2 inches deep (depth with letter size paper tray installed—28.2 inches)
Weight	77 lbs.

The Apple LaserWriter Plus

The success of the original LaserWriter was followed by that of the LaserWriter Plus, a similar model having an expanded set of built-in fonts.

You can upgrade a LaserWriter Plus to the later and faster version of PostScript contained in the new LaserWriter II models. Apple has a dealer-installed kit called "LaserWriter Plus Upgrade Kit."

In addition, the LaserWriter and LaserWriter Plus can be enhanced with a few add-ons. For example, you can add memory to increase the number of downloadable fonts with Mass Micro's MassFonts card.

The LaserWriter Plus has the following specifications:

RAM	1.5 megabyte
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor at 11.16 megahertz
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats.
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo 630
Printing speed, max.	8 pages/min.
Interfaces	Two serial ports (one D25 for RS-232C, one D9 for RS-422 and AppleTalk)
Recommended Duty Cycle	Less than 4,000 pages per month
Recommended paper	16–21 pound single sheet photocopy bond. 8–34 pound letterhead and colored stock. Standard weight transparency stock.
Paper sizes	Letter, legal, A4, and B5 sizes.
Paper bin capacity	100 sheets
Max. printable area	US letter—8.0 by 10.78 inches. Legal—6.75 by 12.84 inches. A4—7.41 by 10.86 inches. B5—7.69 by 10.16 inches.
Output tray capacity	20 sheets face up
Operating noise	50 db max at bystander position during standby and 60 db during printing.
Power consumption	Standby—170 watts average. Printing—900 watts maximum.
Dimensions	11.5 high by 18.5 wide by 16.2 inches deep (depth with letter size paper tray installed—28.2 inches)
Weight	77 lbs.

Apple's LaserWriter II Series

The newest laser printers from Apple are a complete redesign. The laser engine, the Canon LBP-SX, is a lower profile and has an improved toner system that produces darker, more realistic blacks.

The resulting LaserWriter II models are somewhat lighter in weight, have convenient face-up and face-down output trays, larger paper input cassettes, a built-in manual feed guide, simpler paper path to lessen the possibility of paper jams, and a much more attractive exterior design.

These newest printers are really a series, too. Each one can be converted to the other with a simple controller board swap; it takes just one or two minutes, and the only tool required is a Phillips screwdriver.

LaserWriter II SC

In early 1988, Apple introduced a popularly priced laser printer based on its own QuickDraw graphics routines. This is Apple's first venture into a non-PostScript laser printing environment.

In actuality, the three new printers from Apple, its LaserWriter II series, are one printer that can be configured with one of three different controller boards—the electronic brains of the laser printer. The installation is fast and easy. The boards are held in by two screws. Nothing could be easier. This means that if you ever decide that you need the publishing power of PostScript, you can have your LaserWriter II SC easily upgraded by a local dealer with a simple board swap.

This low-end model is described more fully in Chapter Twelve, but here are the basic specifications:

RAM	1 megabyte	Paper sizes	Letter, legal, A4, and B5 sizes
ROM	32K		
Controller	32-bit Motorola 68000 processor at 7.5 megahertz	Paper bin capacity	200 sheets, optional envelope tray
Resolution	300 dots per inch	Max. printable area	US letter—8.0 by 10.99 inches. Legal—6.75 by 13.0 inches. A4—7.41 by 10.86 inches. B5—7.69 by 10.16 inches.
Fonts	Times, Helvetica, Courier, Symbol		
Font Types	bit-mapped, scaled down four times		
Font Sizes	9, 10, 12, 14, 18, and 24-point sizes, with corresponding 4X size for each.	Output tray capacity	100 sheets face down, 20 sheets face up.
		Operating noise	50 db max at bystander position during standby and 60 db during printing.
Printer protocols	QuickDraw		
Printing speed, max.	8 pages/min.	Power consumption	Standby—170 watts average. Printing—900 watts maximum.
Interfaces	Single user SCSI interface	Dimensions	8.6 high by 20 wide by 18.5 inches deep (width with letter size paper tray installed—26.5 inches)
Recommended Duty Cycle	5,000 pages per month		
Recommended paper	16–21 pound single sheet photocopy bond. 8–34 pound letterhead and colored stock. Standard weight transparency stock.	Weight	45 lbs.

LaserWriter II NT

The development of Canon's second generation SX laser engine brought a more compact design to the LaserWriter II models. In addition, a more reliable and longer duty cycle was established.

This redesign also enabled Apple to use a more recent version of PostScript, Version 47, which is significantly faster. In addition, this increased speed is enhanced by the larger amount of RAM (2 megabytes) installed in this model.

Consequently, it's really more than just a simple rehash of the earlier printer; it offers a substantial operating benefit on account of its new design and specifications.

If you're used to using a LaserWriter Plus, you will see a noticeable speed increase when you use the newer NT.

The LaserWriter II NT has the following specifications:

RAM	2.0 megabyte
ROM	1.0 megabyte
Controller	32-bit Motorola 68000 processor at 11.16 megahertz
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats.
Font Types	PostScript Bezier outline, scalable
Printer protocols	PostScript, Diablo 630
Printing speed, max.	8 pages/min.
Interfaces	Two serial ports (one D25 for RS-232C, one MINI DIN-8 for RS-422 and AppleTalk)
Recommended Duty Cycle	5,000 pages per month
Recommended paper	16–21 pound single sheet photocopy bond. 8–34 pound letterhead and colored stock. Standard weight transparency stock.
Paper sizes	Letter, legal, A4, and B5 sizes.
Paper bin capacity	200 sheets, optional envelope tray
Max. printable area	US letter—8.0 by 10.78 inches. Legal—8.0 by 13.78 inches. A4—7.79 by 11.08 inches. B5—6.45 by 9.76 inches.
Output tray capacity	100 sheets face up.
Operating noise	50 db max at bystander position during standby and 60 db during printing.
Power consumption	Standby—170 watts average. Printing—900 watts maximum.
Dimensions	8.5 high by 20 wide by 16.2 inches deep (depth with letter size paper tray installed—28.2 inches)
Weight	46 lbs.

LaserWriter II NTX

Since publishing is a major application of the PostScript LaserWriters, Apple has wisely introduced the extremely versatile, expandable LaserWriter II NTX. You've got printing speeds cranked up to at least four times that of the LaserWriter II NT, a SCSI port to add a hard disk full of fonts at your beck and call, there's room to add up to 12 megabytes of memory for downloaded fonts and there's room for font cards—up to 8 megabytes worth. In addition, once the typeface is downloaded to the attached hard disk, it can be removed from your System file.

With all this memory available, the printer can store particular font sizes as it creates them (this is called *font caching*) rather than re-calculating them each time they're needed. Thus, the actual scaled bit-maps created from the PostScript outlines are stored for reuse during the day's work rather than being recreated each time they're needed. Font caching greatly speeds up the printing of pages that use the previously printed font.

Every PostScript printer uses part of the RAM as a font cache and adds newly calculated fonts as they are created while dumping the least recently used ones to make room. These fonts stay there until the printer is turned off or reset.

On the NTX, a sizeable portion of the attached hard disk is set aside as a font cache. Thus, when the RAM cache fills up, it offloads the excess to the hard disk. Then, at the end of the printing, the font cache remaining in RAM is sent to the hard disk for storage. With this procedure, your LaserWriter II NTX, when attached to a hard disk, may have to convert the PostScript outlines to their actual bit-mapped equivalents only once in it's entire lifetime. This printer is built for heavy-duty publishing.

In addition, this printer processes PostScript like no other desktop laser printer in its price range. It's using the same microprocessor that the Macintosh II uses and gets a big boost from the 68881 math coprocessor chip. Remember, scaling typefaces in PostScript is very calculation-intensive. The math chip really speeds things up.

You also get Hewlett-Packard LaserJet+ emulation for handling applications from PCs that unfortunately lack a PostScript driver.

Beware of adding a hard disk from a manufacturer other than Apple. There have been some reports that a few hard disks won't work with the NTX. This is not Apple's fault. There seem to be a few drive manufacturers who haven't implemented the standard SCSI interface correctly.

The LaserWriter II NTX specifications are as follows:

RAM	2.0 megabyte, expandable to 12 megabytes
ROM	1.0 megabyte. Can accept up to 3 megabytes of ROM on main board and up to an additional 8 megabytes of ROM on an expansion board. These will be in the form of font cards developed by third parties.
Controller	32-bit Motorola 68020 processor at 16.67 megahertz and 68881 math coprocessor
Resolution	300 dots per inch
Fonts	Times, Helvetica, Helvetica Narrow, Courier, Symbol, Palatino, ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, ITC Zapf Chancery, ITC Zapf Dingbats

Font Types	PostScript Bezier outline, scalable	Max. printable area	US letter—8.0 by 10.78 inches. Legal—8.0 by 13.78 inches. A4—7.79 by 11.08 inches. B5—6.45 by 9.76 inches.
Printer protocols	PostScript, Diablo 630, Hewlett-Packard LaserJet +		
Printing speed, max.	8 pages/min.		
Interfaces	Two serial ports (one D25 for RS-232C, one MINI DIN-8 for RS422 and AppleTalk), one external SCSI port for a hard disk.	Output tray capacity	100 sheets face up.
		Operating noise	50 db max at bystander position during standby and 60 db during printing
Recommended Duty Cycle	5,000 pages per month	Power consumption	Standby—170 watts average. Printing—900 watts maximum.
Recommended paper	16–21 pound single sheet photocopy bond. 8–34 pound letterhead and colored stock. Standard weight transparency stock.	Dimensions	8.5 high by 20 wide by 16.2 inches deep (depth with letter size paper tray installed—28.2 inches)
Paper sizes	Letter, legal, A4, and B5 sizes.	Weight	46 lbs.
Paper bin capacity	200 sheets, optional envelope tray		

The LaserWriter II models are a family. In fact, they are shipped to the dealer without a controller board. The dealer stocks just one printer. Dealers order and inventory each model's controller card separately and assemble the specific model you want by installing the appropriate board before delivering it to you.

The modular design of Apple's LaserWriter II series works to your advantage. Easy upgrading of the functionality will keep your printer abreast of your needs, especially if you enter the more demanding areas of desktop publishing, presentation graphics, or computerized drafting and engineering.

The LaserWriter II engine is a common platform to take you from simple to extremely demanding usage.

One of the most common complaints of laser printer buyers is the greatly expanded applications they want to use *after* they've purchased a laser printer. After all, once you've seen the beautiful quality of laser printing, you want to do more and more things with it. It's simply human nature. Having an easy upgrade path could thus be a very important and a very, very cost-effective choice.

APPENDIX **B**

The LaserWriter Typefaces

The LaserWriter II NT and NTX have eleven built-in typefaces. Don't believe that other PostScript laser printers have more than this when you read that they have "thirty-five fonts." Remember, fonts are a typeface in one particular size and style. When the "thirty-five font" figure is thrown at you, it includes such things as plain (roman), bold, italic, etc. The number of typefaces present in a PostScript printer is usually eleven. Sometimes there are a bit fewer, and it seems that Zapf Digbats gets left out when fewer typefaces come built-in.

The *LaserWriter Owner's Guide* shows the composition of each typeface resident in the LaserWriter, but, unfortunately, Apple doesn't tell you exactly what order they are in, which limits the usefulness of the listing.

In the table below, each typeface family is shown in the following order: First, the standard keyboard characters are listed. The first two lines are the alphabetical characters in lower case and capitals, or upper case. Second, the numerals and punctuation taken from the keyboard left to right are listed, beginning with the top row of keys and then going down the rows of keys from left to right. Finally, the Option character set is shown in the same sequence as the standard characters.

Avant Garde

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRST UVWXYZ

numerals & punctuation -

`1234567890-=()\;',./

upper case numerals, etc. -

~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©´^Δ˚¬µ~øπœ®ß†¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔ♉Ò˜ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. -

`¡£¢∞§¶•ªº–≠‟‘«…æ≤≥÷

upper case numerals, etc. -

Ÿ/¤‹›fifl‡°·‚—±”’»ÚÆ˜¯¿

Bookman

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRST UVWXYZ

numerals & punctuation -

`1234567890-=[]\;',./

upper case numerals, etc.-

~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©´^Δ˚¬µ~øπœ®ßþ¨√

upper case - ÅıÇÎ‰ïÌÓÈÔ♉Ò˜ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. -

`¡£¢∞§¶•ªº–≠‟‘«…æ≤≥÷

upper case numerals, etc. -

Ÿ/¤‹›fifl‡°·‚—±”’»ÚÆ˜¯¿

Courier

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRSTUVWXYZ

numerals & punct. -

`1234567890-=[]\;',./

upper case numerals, etc.-

~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©´^Δ˚¬µ~øπœ®ß†¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔ♉Ò˜ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. -

`¡£¢∞§¶•ªº–≠‟‘«…æ≤≥÷

upper case numerals, etc.-

Ÿ/¤‹›fifl‡°·‚—±”’»ÚÆ˜¯¿

Helvetica

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRSTUV WXYZ

numerals & punctuation -

`1234567890-=[]\;',./

upper case numerals, etc.-

~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©´^Δ˚¬µ~øπœ®ßþ¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔ♉Ò˜ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. -

`¡£¢∞§¶•ªº–≠‟‘«…æ≤≥÷

upper case numerals, etc. -

Ÿ/¤‹›fifl‡°·‚—±”’»ÚÆ˜¯¿

Helvetica Narrow

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRSTUVWXYZ

numerals & punctuation -

`1234567890-=[]\;',./

upper case numerals, etc.-

~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©´^Δ˚¬µ~øπœ®ßþ¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔ♉Ò˜ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. - `¡£¢∞§¶•ªº–≠‟‘«…æ≤≥÷

upper case numerals, etc. -

Ÿ/¤‹›fifl‡°·‚—±”’»ÚÆ˜¯¿

New Century Schoolbook

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRST UVWXYZ

numerals & punctuation - `1234567890-=[]\;',./

upper case numerals, etc.- ~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©˙^∆˚¬µ~øπœ®ß†¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔÒ˝ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. - `¡£¢∞§¶•ªº–≠“‘«…æ≤≥÷

upper case numerals, etc. - Ÿ⁄¤‹›ﬁﬂ‡°·‚—±”’»ÚÆ¯˘¿

Palatino

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRST UVWXYZ

numerals & punctuation - `1234567890-=[]\;',./

upper case numerals, etc.- ~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©˙^∆˚¬µ~øπœ®ß†¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔÒ˝ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. - `¡£¢∞§¶•ªº–≠“‘«…æ≤≥÷

upper case numerals, etc. - Ÿ⁄¤‹›ﬁﬂ‡°·‚—±”’»ÚÆ¯˘¿

Symbol

Regular characters:

lower case - αβχδεφγηιϕκλμνοπθρστυϖωξψζ

upper case - ΑΒΧΔΕΦΓΗΙϑΚΛΜΝΟΠΘΡΣΤ ΥςΩΞΨΖ

numerals & punctuation - ‾1234567890−=[]∴;∋,./

upper case numerals, etc.- ~!≅#∃%⊥&∗()_+{}|:∀<>?

Option characters:

lower case - ∂↔⊗♥⊥∅ℜ∝∼⊄≠⊄♦♣←℘

upper case - ⌡⌊™⎨⌈⎪◊〉⎬↓÷∈∑⎛⋅©⎢⎟⎧

numerals, etc. - ‾ℑ♠≤′⁄ƒ∞≈…∠↑®™∩⊃—″≥√

upper case numerals, etc.- ∧∨⇔⇐⇑⇒⇓◊ϒ〈®∇±©∏∪⌠→⌉ℵ

Times

Regular characters:

lower case - abcdefghijklmnopqrstuvwxyz

upper case - ABCDEFGHIJKLMNOPQRST UVWXYZ

numerals & punctuation - `1234567890-=[]\;',./

upper case numerals, etc.- ~!@#$%^&*()_+{}|:"<>?

Option characters:

lower case - åçð´ƒ©˙^∆˚¬µ~øπœ®ß†¨√

upper case - ÅıÇÎ‰ÏÌÓÈÔÒ˝ˆØ∏ŒÂÍÊË◊„ÙÁÛ

numerals, etc. - `¡£¢∞§¶•ªº–≠“‘«…æ≤≥÷

upper case numerals, etc.- Ÿ⁄¤‹›ﬁﬂ‡°·‚—±”’»ÚÆ¯˘¿

Zapf Chancery

Regular characters:

lower case - *abcdefghijklmnopqrstuvwxyz*

upper case - *ABCDEFGHIJKLMNOPQRSTUV WXYZ*

numerals & punctuation - *`1234567890-=[]\;',./*

upper case numerals, etc.- *~!@#$%^&*()_+{}|:"<>?*

Option characters:

lower case - *åçð´ƒ©˙^∆˚¬µ~øπœ®ß†¨√*

upper case - *ÅıÇÎ‰ÏÌÓÈÔÒ˝ˆØ∏ŒÂÍÊË◊„ ÙÁÛ*

numerals, etc. - *`¡£¢∞§¶•ªº–≠“‘«…æ≤≥÷*

upper case numerals, etc. - *Ÿ⁄¤‹›ﬁﬂ‡°·‚—±”’»ÚÆ¯˘¿*

Zapf Dingbats

Regular characters:

lower case - ❁❂❃❄❅❆❇❈❉❊❋●❍■❏
❐❑❒▲▼◆❖◗❘❙❚

upper case - ✡✢✣✤✥✦✧★✩✪✫✬✭✮
✯✰✱✲✳✴✵✶✷✸✹✺

numerals & punctuation - ❀✑✒✓✔✕✖✗✘✙✐✍
✝✻✽✼✛✇✌✎✏

upper case numerals, etc. - ❞✁✠✃✄☎✾✆☛✈
✉✿☞❛❝❜✚✂✜✞✟

Option characters:

lower case - ❴❵❶♠⑤♦➝❈⑦➻③⑩❞➉➍
❻♣❧ ①④

upper case - ❩➺❨➯➤➮➩➪➫➬ ➭➘➚④➌
❺➥➱➦➡↕➢➘➷➼

numerals, etc. - ❀②❢❣⑤❤❥❦➅❼➆②➈➔⑧
⑩❾⑦⑧↔

upper case numerals, etc. - ➞➚➛➜→⟶➝➟❡➠➣
❽⑥➓→⑨➲③➼➹①

APPENDIX **C**

Sources for Products Mentioned

Abaton Technology Corp., 7901 Stoneridge Dr., Suite 500
Pleasanton, CA 94566 (415) 463-8822

Adobe Systems Inc., 1585 Charleston Rd., Box 1700
Mountain View, CA 94039-7900
(415) 961-4400, (800) 29-ADOBE

Aldus Corp., 411 First Avenue South
Seattle, WA 98104 (206) 622-5500

Alisa Systems Inc., 221 E. Walnut St., Suite 230
Pasadena, CA 91101 (818) 792-9474

Allan Bonadino Associates, 1579 Dolores St.
San Francisco, CA 94110-4928
(415) 282-5864

Allied Linotype Co., 425 Oser Ave.
Hauppauge, NY 11788 (516) 434-2016

Allotype Typographics, 1600 Packard Rd., Suite 5
Ann Arbor, MI 48104 (313) 577-3055

Alphabets, Inc., 804 Dempster St.
Evanston, IL 60202 (312) 328-2733

ALSoft Inc., Box 927
Spring, TX 77383-092 (713) 353-4090

Altsys Corp., 720 Avenue F, Suite 108
Plano, TX 75074 (214) 424-4888

Ann Arbor Softworks, 2393 Teller Road, Suite 106 Newbury Park, CA 91320
(805) 375-1467

S. Anthony Studios, 889 DeHaro St.
San Francisco, CA 94107 (415) 826-6193

Apple Computer Inc., 20525 Mariani Ave.
Cupertino, CA 95014 (408) 996-1010

Applied Engineering, Box 798
Carrollton, TX 75006 (214) 241-6060

Apollo Computer Inc., 330 Billerica Rd.
Chelmsford, MA 01824 (617) 256-6600

Artmaster, 500 N. Claremont Blvd., 1st Floor,
Claremont, CA 91711 (714) 621-3282

Artware Systems Inc., 3741 Benson Dr.
Raleigh, NC 27609 (800) 426-3858;
(919) 872-6511

AST Research Inc., 2121 Alton Ave.
Irvine, CA 92714 (714) 553-0340

AT&T Electronic Photography and Imaging Center, 7351 Shadeland Station
Indianapolis, IN 46256 (800) 858-8783

Avenue Software, Inc., 1173 W. Charest Blvd., Suite 250
Quebec City, Quebec, Canada G1N 2C9
(418) 682-3088

BDT Products Inc., 17152 Armstrong Ave.
Irvine, CA 9271 (800) 346-3238, in CA (714) 660-1386

Banyan Systems Inc., 115 Flanders Rd.
Westboro, MA 01581 (617) 898-1000

Besearch Information Services, 26160 Edelweiss Circle
Evergreen, CO 80439 (303) 674-8875

Beyond Software, 3865 N. Oracle Rd.
Tucson, AZ 85705 (602) 888-8867

BioScan, 4520 Union Bay Place NE
Seattle, WA 98105 (800) 426-0700, in WA (206) 523-5000

Bitstream Inc., 215 First St.
Cambridge, MA 02142 (800) 522-3668 or (617) 497-6222

Boston Computer Society Mac User's Group, 48 Grove St.
Somerville, MA 02144

Brainpower, 24009 Ventura Blvd.
Calabasas, CA 91302 (800) 345-0519; in CA (818) 884-6911

Buffalo Products, 859 Cowan Rd.
Burlingame, CA 9401 (800) 345-2356, in CA (800) 543-2356

ByteSize Graphics, 311 Portola Rd.
Portola Valley, CA 94025 (415) 851-2330

Casady Ware, Box 223779
Carmel, CA 93992 (800) 331-4321, (800) 851-1986 in CA

Casey's Page Mill, 6528 S. Oneida Ct.
Englewood, CO 80111 (303) 220-1463

CE Software, 1854 Fuller Road
West Des Moines, IA 50265 (515) 224-1995

Century Software Inc., 2483 Hearst Ave., #175
Berkeley, CA 94709 (800) 222-TOPS, (415) 549-1901

Challenger Software, 18350 Kedzie Ave.
Homewood, IL 60430 (800) 858-9565, in IL (312) 957-3475

ChartPak, 1 River Road
Leeds, MA 01053 (413) 584-5446

Claris Corp., 440 Clyde Ave.
Mountain View, CA 94043 (800) 544-8554; (415) 960-2790

CLEO Software, 1639 N. Alpine Rd.
Rockford, IL 61107 (800) 233-2536, in IL (800) 422-2536

CMS Enhancements Inc., 1372 Valencia Ave.
Tustin, CA 92680 (714) 259-9555

Compatible Systems Corp., P.O. Drawer 17220
Boulder, CO 80308-7220 (303) 444-9532

Comp-Link Inc., 9225 Katy Freeway, Suite 415
Houston, TX 77024 (713) 688-8300

Composition Technologies Inc., 505 Boulevard Dorchester East
Montreal, PQ H2Z 1A8, Canada
(514) 875-7586

Compugraphic Corp., 200 Ballardville St.
Wilmington, MA 01887 (800) 822-5524

Compuset, 517 Third St., Suite 40
Eureka, CA 94022 (707)443-8602

Computer Productions Unlimited, Inc.,
78 Bridge St.
Newburgh, NY 12550 (914) 565-6262

Comtrex Ltd., Box 550
Newport Beach, CA 92662 (714) 855-6600

Cooke Publications, Box 4448
Ithaca, NY 14852 (800) 482-4438,
in NY (800) 435-4438

Corel Systems Corp., 1600 Carling Blvd.
Ottawa, Ontario, K1A 7M4 Canada
(613) 728-8200

Corvus Systems, Inc., 2100 Corvus Dr.
San Jose, CA 95124 (408) 559-7000

Cricket Software, 40 Valley Stream Parkway
Malvern, PA 19355 (800) 345-8112,
in PA (215) 251-9890

Dagra/Set, 113 Emmons Rd.
Lansing, NY 14882 (607) 533-4710

Datacopy, 1215 Terra Bella Ave.
Mountain View, CA 94043 (800) 821-2898,
in CA (415) 965-7900

Data Design, 1975 Willow Pass Rd.
Concord, CA 94520 (415) 680-6818

Dataspace Corp., 185 Riviera Dr, Unit 9
Markham, Ontario, Canada L3R 5J6
(800) 387-0492

DataSpec, 20120 Plummer St.
Chatsworth, CA 91313 (818) 701-5848

Data Translation Inc., 100 Locke Dr.
Marlboro, MA 01752 (617) 481-3700

DataViz Inc., 16 Winfield St.
Norwalk, CT 06855 (203) 866-4944

Davka, 845 N. Michigan Avenue, Suite 843
Chicago, IL 60611 (312) 944-4070

Dayna Communications, 50 So. Main St.,
Suite 530
Salt Lake City, UT 84144 (800) 531-0600

Decision Science Software, Box 1483
Sugarland, TX 77487 (713) 491-0073

Deneba Software, Inc., 7855 NW 12th St.,
Suite 202
Miami, FL 33126 (305) 594-6965

Design Science, 6475-B East Pacific Coast
Hwy., Suite 392
Long Beach, CA 90803 (213) 433-0685

Desktop Graphics, 400 Country Dr. #H
Dover, DE 19901 (800) 541-0900,
in CA (800) 334-3030

Dest Corp., 1201 Cadillac Court
Milpitas, CA 95035 (800) 538-7582,
in CA (408) 946-7100

Devonian International Software Co., Box 2351
Montclair, CA 91763 (714) 621-0973

Digital Research Inc., Box DRI
Monterey, CA 93942 (408) 649-3896

Dove Computer Corp., 1200 N. 23rd St.
Wilmington, NC 28405 (800) 622-7627

DuPont Connector Systems,
515 Fishing Creek Rd.
New Cumberland, PA 17070 (800) 237-2374

Dynamic Graphics, 6000 N. Forest Park Dr.
Peoria, IL 61656 (309) 688-8800

Eastern Language Systems, 39 West 300 North
Provo, UT 84601 (801) 377-4558

Ecological Linguistics, Box 15156
Washington, DC 20003 (202) 546-5862

Edco Services, Inc.,
12410 North Dale Mabry Hwy.
Tampa, FL 3361 (800) 523-TYPW,
(813) 962-7800

Educomp Computer Services, 742 Genevieve, Suite D
Solana Beach, CA 92075 (800) 843-9497, in CA (800) 654-5181

Electric Typographer, 2216 Cliff Dr.
Santa Barbara, CA 93109 (805) 966-7563

EmDash, Box 8256
Northfield, IL 60093 (312) 441-6699

Emerald City Software, 97 Jennings Lane
Atherton, CA 94025 (415) 368-8303

Enabling Technologies Inc., 600 S. Dearborn, Suite 1304
Chicago, IL 60605 (312) 427-0408

Ergotron Inc., 1621 E. 79th St., Suite C133
Minneapolis, MN 55420 (800) 328-9839

EuroSoft International Inc.,
14082 Loma Rio Dr.
Saratoga, CA 95070 (408) 741-0739

Excelan Inc., 2180 Fortune Dr.
San Jose, CA 93131 (408) 434-2300

Farallon Computing, 2150 Kittredge St.
Berkeley, CA 94704 (415) 849-2331

Folkstone Design, Inc., Box 86982
North Vancouver, BC, Canada V7L 4P6
(604) 986-8060

General Computer Corp., 580 Winter St.
Waltham, MA 02154 (617) 890-0880

Gestetner Corp., Gestetner Park
Yonkers, NY 10703 (914) 968-6666

GMGP, 120 Walton St.
Syracuse, NY 13202 (315) 426-0513

GoldMind Publishing, 12155 Magnolia Ave., Suite 3-B
Riverside, CA 92503 (714) 785-8685

Graphic Presentation Charts, 23 Exford Dr.
Scarborough, Ontario, Canada M1P 1L5
(416) 751-2727

Hayes Microcomputer Products, Inc.,
Box 105203
Atlanta, GA 30348 (404) 441-1617

Heizer Software, 5120 Coral Ct., Suite 203
Concord, CA 94521 (415) 827-9013

Hercules Computer Technology, 921 Parker St.
Berkeley, CA 94710 (415) 540-0212

Hewlett-Packard Business Computing Systems, 11000 Wolfe Rd.
Cupertino, CA 95014 (800) 367-4772

HUG Software, Hilltop Road
St. Joseph, MO 49085 (616) 982-3463

Johnson & Johnson Design/Build, 677 Grave St.
Newton, MA 02162 (617) 253-5965

Image Club Graphics, 2828 19th St. N.E.
Calgary, Alberta Canada T2E 6Y9
(403) 250-1969

Image Express,
6479 Peachtree Industrial Blvd., Suite D
Atlanta, GA 30360 (404) 458-9222

Information Presentation Technologies,
Box 8609
Calabasas, CA 991302 (818) 347-7791

Infosphere Inc., 4730 SW Macadam Ave.
Portland, OR 97201 (800) 445-7085;
(503) 226-3620

Infotek Inc., 56 Camille
E. Patchogue, NY 11772 (516) 289-9682

InSet Systems Inc., 12 Mill Rd.
Danbury, CT 06811 (800) 828-8088

Insignia Solutions Inc., 1255 Post St., Suite 625
San Fransisco, CA 94109 (415) 885-4455

Institute of Typographical Research,
64 Budwar Peth, Ganpati Chowk, Laxami Rd.
Pune, India 411 002

International Computer Consultants,
1311 Clegg St.
Petaluma, CA 94952 (707) 765-9200

Itek Graphix Corp., 34 Cellu Dr.

Nashua, NH 03063 (800) 654-9500

KAZ Business Systems,
10 Columbus Circle, Suite 1620
New York, NY 10019 (212) 757-9566

Kensington Microware Ltd., 251 Park Ave.
New York, NY 10010 (800) 535-4242,
in NY (212) 475-5200

Kinetics Inc., 2500 Camino Diablo, Suite 110
Walnut Creek, CA 94596 (415) 947-0998

Kingsley ATF Type Co., 200 Elmora Ave.
Elizabeth, NJ 07202 (800) 289-TYPE

Knowledge Engineering, GPO Box 2139
New York, NY 10016 (212) 473-0095

Koala Technologies, 269 Mt. Hermon Rd.
Scotts Valley, CA 95066 (408) 438-0966

Kroy Sign Systems, 7560 East Redfield Rd.
Scottsdale, AZ 85260 (800) 521-4997

LaserCount Systems Inc., 103 Blue Ridge Trail
Austin, TX 78746 (512) 327-2778

LaserGraphics Corp., 3741 Benson Dr.
Raleigh, NC 27609 (919) 872-6511

Laser Technologies, Int'l.,
15403 E. Alondra Blvd.
La Mirada, CA 90638 (714) 739-2478

LaserTools Corp., 3025 Buena Vista Way
Berkeley, CA 947808 (415) 843-2234

LaserWare, Inc., Box 668
San Rafael, CA 94915 (800) 367-6898;
(415) 453-9500

Legend Communications, 54 Rosedale Ave.
Brampton, Ontario L6X 1K1 (416) 457-6298

Letraset USA, 40 Eisenhower Dr.
Paramus, NJ 07652 (201) 845-6100

Lexisoft, Inc., Box 1950
Davis, CA 95617 (916) 758-3630

Zuzana Licko Design, 2431 Russell St.
Berkeley, CA 94705 (415) 841-4161

Linguist's Software, 106R Highland St.
South Hamilton, MA 01982 (617) 468-3037

Linkware Corp., 77 Rumford Ave.
Waltham, MA 02154 (800) 356-1212

London Pride, Inc., 1 Birch St.
Norwalk, CT 06851-5105 (203) 866-4806

Lutzky-Baird Associates,
23801 Calabasas Rd. #2011
Calabasas, CA 91302 (818) 347-7791

Paul Mace Software, 400 Williamson Way
Ashland, OR 97520 (800) 523-0258,
(503) 488-0224

MacPEAK Systems, 1201 Spyglass
Austin, TX 78746 (800) 225-7509;
(512) 328-0747

MacTimes Press, 1174 Barnes St., Suite 400
Franklin Square, NY 11010 (516) 775-8841

MacTography, 702 Twinbrook Pkwy.
Rockville, MD 20851 (301) 424-3942

MassMicro Systems, 3250 Jay St.
Santa Clara, CA 95040 (800) 253-8900;
in CA (408) 988-1200

MathType Design Science, 6475-B E. Pacific
Coast Hwy., Suite 392

Long Beach, CA 90803 (213) 433-0685
Menlo Business Systems, Inc., 334 State St.
Los Altos, CA 94022 (415) 948-7920

Mesa Graphics Inc., Box 600
Los Alamos, NM 87544 (505) 672-1998

Metaresearch Inc., 1211 SW Fifth, #2860
Portland, OR 97204 (503) 228-5806

Metro ImageBase, 4949 Genesta Ave.
Encino, CA 91316 (818) 906-8817

Micro Dynamics, Ltd., 8555 16th St., Suite 802
Silver Spring, MD 20910 (800) 634-7638,
in MD (301) 589-6300

Micron Technology Inc., 2805 E. Columbia Rd.
Boise, ID 83706 (208) 386-3800

Microsoft Corp., 16011 NE 36th Way
Redmond, WA 98073-0717 (800) 426-9400;
(206) 882-8080

Micro Solutions Inc., 132 West Lincoln Hwy.
DeKalb, IL 60115 (815) 756-3411

Mindscape Inc., 3444 Dundee Rd.
Northbrook, IL 60062 (312) 480-7667

Modern Graphics, Box 21366
Indianapolis, IN 46221-0366 (317) 253-4316

Multi-Ad Services, Inc., 1720 W. Detweiller Dr.
Peoria, IL 61615 (309) 692-1530

Mumford Micro Systems, Inc., Box 400
Summerland, CA 93067 (805) 969-4557

NeoScribe International, Box 633
East Haven, CT 06512 (203) 467-9880

Netdesign, 876 Embarcadero Rd.
Palo Alto, CA 94303 (415) 326-1321

New Image Technology, Suite 104,
10300 Greenbelt Rd.
Seabrook, MD 20706 (301) 464-3100

Nikrom Technical Products, 176 Fort Pond Rd.
Shirley, MA 01464 (800) 835-2246,
in MA (617) 537-9970

Northern Telecom, 2305 Mission College Blvd.
Santa Clara, CA 95054 (408) 988-5550

Novell, Inc., 122 East 1700 South
Provo, UT 84601 (801) 379-5900

Nuvotech Inc., 2015 Bridgeway, Suite 204
Sausalito, CA 94965 (415) 331-7815

Olduvai Corp., 7520 Red Road, Suite A
South Miami, FL 33143 (305) 665-4665

Omnichrom Systems Corp., 40 Nickerson Rd.
Ashland, MA 01721 (800) 443-4031,
in MA (617) 881-4105

OmniGate Inc., 351 California St.
San Fransisco, CA 94101 (415) 781-6464

123LASER, 140 University Ave., Suite 156
Palo Alto, CA 94301 (415) 322-4609

PC Quik-Art Inc., 394 S. Milledge Ave., Suite 200
Athens, GA 30606 (800) 523-1796, in GA
(404) 543-1779

PS Publishing Inc., 290 Green St.
San Fransisco, CA 94133 (415) 433-4698

Pacer Software Inc.,
7911 Herschel Ave, Suite 402
La Jolla, CA 92037 (619) 454-0565

Page Studio Graphics,
3175 North Price Road, # 1050
Chandler, AZ 85224 (602) 839-2763

Paperback Software, 2830 Ninth St.
Berkeley, CA 94710 (415) 644-2116

Peregrine Falcon,
2330 Marinship Way, Suite 307
Sausalito, CA 94965 (415) 331-8131

PerfecTEK Corporation, 726 So. Hillview Dr.
Milpitas, CA 95035 (408) 263-7757

Peripheral Computers & Supply,
2457 Perkiomen Ave.
Redding, PA 19606 (215) 779-0522

Peripheral Land Inc., 47800 Westinghouse Dr.
Fremont, CA 94538 (415) 657-2211

Pixelogic Inc., 38 Montvale Ave.
Stoneham, MA 02180 (617) 438-5520

Postcraft International Inc.,
27811 Avenue Hopkins, Suite 6
Valencia, CA 91355 (805) 257-1797

Publishing Resources Inc., 1795 Pearl St.
Boulder, CO 80302-9998 (800) 553-1666,
in CO (303) 442-1100

Pyramid Technology, 1295 Charleston Rd.
Mountain View, CA 94039 (415) 965-7200

QMS Inc., 1 Magnum Pass
Mobile, AL 36618 (800) 631-2692

Qualitas Trading Co.,
323 Monte Vista Ave., Suite 307
Oakland, CA 94611 (415) 547-1520

Quark Inc., 2525 W. Evans, No. 220
Denver, CO 80219 (800) 543-7711

Renaissance GRX Inc., 2265 116th Ave. NE
Bellevue, WA 98004 (206) 454-8086

Scenicsoft, Inc., 250 Harbor Bldg.,
100 Second Ave. S.
Edmonds, WA 98020 (206) 776-7760

Shiva Corp., 222 Third St.
Cambridge, MA 02142 (617) 661-2026

Silicon Beach Software, Inc., Box 261430
San Diego, CA 92126 (619) 695-6956

SMK, 5760 S. Blackstone Ave.
Chicago, IL 60637 (312) 947-9157

SoftShell Co., 2004 N. 12th St.
Grand Junction, CO 81501 (303)242-7502

Software Complement, 8 Pennsylvania Ave.
Malvern, PA 18336 (717) 491-2492

Software for Recognition Technologies,
55 Academy Dr.
Rochester, NY 14623 (716) 461-0923

Software Supply, 599 N. Mathilda Ave., #210
Sunnyvale, CA 94086 (408) 749-9311

Software Ventures, Inc., 2709 Claremont Ave.
Berkeley, CA 94705 (415) 644-3232

Solana Electronics, 7887 Dunbrook Rd., Suite A
San Diego, CA 92126 (619) 566-1701

Solutions International, 29 Main St.
Montpelier, VT 05602 (802) 229-9146

SourceNet, Box 6767
Santa Barbara, CA 93160 (805) 964-6066

Southeastern Software, 7743 Briarwood Dr.
New Orleans, LA 70128 (504) 246-8438

Specific Solutions, 1898 Anthony Court
Mountain View, CA 94040 (415) 941-3941

SSG Laserworks, 6376 Quail Run
Kalamazoo, MI 49009 (616) 375-8996

Sterling Computer Products, Inc., Box 271130
Escondido, CA 92037 (800) 227-5525,
in CA (800) 523-4982

Studio Advertising Art, Box 18432-52
Las Vegas, NV 89114 (800) 235-6646, ext 227,
in CA (800) 235-6647, ext 227

SuperMac Software, 295 Bernardo Ave.
Mountain View, CA 94043 (415) 964-8884

SymSoft, 444 First St.
Los Altos, CA 94022 (415) 941-1552

Synergetics, Box 809B
Thatcher, AZ 85552 (602) 428-4073

Synex, 692 Tenth St.
Brooklyn, NY 11215 (718) 499-6293

T/Maker Co., 1973 Landings Dr.
Mountain View, CA 94043 (415) 962-0195

Tangent Technologies Ltd.,
5720 Peachtree Parkway
Norcross, GA 30092 (404) 662-0366

Taylored Graphics, Box 1887
Aptos, CA 95001 (408) 688-3536

Technology Concepts Inc., 40 Tall Pine Dr.
Sudbury, MA 01776 (800) 777-2323;
(617) 443-7311

The Laser Connection, Box 850296
Mobile, AL 36685 (800) 441-4040

The 'Puter Group, 1717 W. Beltline Hwy.
Madison, WI 53713 (608) 273-1803

Think Technologies Inc., 135 South Rd.
Bedford, MA 01730 (800) 64-THINK;
(617) 275-4800

3COM Corp., 1365 Shorebird Way
Mountain View, CA 94039
(800) NET-3COM

3GGraphics, 11410 NE 124th St., #6155-A
Kirkland, WA 98034 (800) 456-0234;
(206) 823-8198

Thunderware, 21 Orinda Way
Orinda, CA 94563 (415) 254-6581

Thursby Software Systems,
5840 W. Interstate 20, Suite 145
Arlington, TX 76017 (817) 478-5070

Toner Research Inc.,
1195 Linda Vista Dr., Suite A
San Marcos, CA 92069 (619) 744-2404

TOPS, a Sun Microsystems Co.,
2560 Ninth St., Suite 220
Berkeley, CA 94710 (415) 549-5900

TouchStone Corp., 909 Electric Ave.
Seal Beach, CA 90740 (213) 598-7746,
(800) 531-0450

Traveling Software Inc.,
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Bothell, WA 98011 (206) 483-8088

Trimar USA Inc., 236 W. 15th St.
New York, NY 10011 (212) 645-7008

Tymlabs Corp., 211 E. 7th St.
Austin, TX 78701 (512) 478-0611

Unisource Software Corp., 23 East St.
Cambridge, MA 02141 (617) 577-8383

Ungermann-Bass Inc.,
2560 Mission College Blvd.
Santa Barbara, CA 95050 (408) 496-0111

Walker Richer & Quinn, Inc.,
2825 Eastlake Ave. E.
Seattle, WA 98102 (206) 324-0350

Wall Data Inc., 17769 NE 78th Place
Redmond, WA 98052 (206) 883-4777

Warp Nine Engineering, Inc.,
1751 West County Rd. B, Suite 107
St. Paul, MN 55113 (800) 654-5294;
in MN (612) 633-3255

White Pine Software, Inc.,
94 Rte 101A, Box 1108
Amherst, NH 03031 (603) 673-8151

Xiphias, 13464 Washington Blvd.
Marina Del Rey, CA 90292 (213) 821-0074

ZSoft Corporation, 450 Franklin Road, Suite 100
Marietta, GA 30067 (404) 428-0008

Zedcor, 4500 E. Speedway, Suite 22
Tucson, AZ 85712 (800) 482-4567, in AZ
(602) 881-8101

Ziyad, Inc., 100 Ford Rd
Denville, NJ 07834 (800) 922-0262 (east
of Miss), (800) 624-6324 (west of Miss),
in NJ (201) 627-7600

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Kabel	Century Software
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DEC Printserver 40	Digital Equipment Corp.
DEC ScriptPrinter	Digital Equipment Corp.
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VAX	Digital Equipment Corp.
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Desktop Art	Dynamic Graphics
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DeluxeMusic Construction Set	Electronic Arts
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Lotus 1-2-3	Lotus Development Corp.
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Final Word II	Mark of the Unicorn, Inc.
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Micron Eye	Micron Technology
WordStar 2000	MicroPro, International
WordStar 2000 Plus	MicroPro, International
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Fleet Street Publisher	Mirrorsoft Ltd.
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DrawStructures	Modern Graphics
ChemText	Molecular Design Ltd.
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Motorola 68020 microprocessor	Motorola Corp.
Motorola 68851 Page Memory Management Unit	Motorola Corp.
PC Paint	Mouse Systems
Kwikee Inhouse	Multi-Ad Services, Inc.
PostCode	Mumford Micro Systems
Musikrafters	Musikrafters Music Services
Integrated Workstation-IWS	NBI
OASys 2000 & 3000	NBI
Macintosh Tailor	NBI
SilentWriter LC-890	NEC Information Systems
Ambo	Neoscribe International
Garajon	Neoscribe International
LaserPerfect	Neoscribe International
Norfolk	Neoscribe International
OCR-A	Neoscribe International
Actinet SE card	Netdesign
PagePlanner Pro	New American Page Planner
LaserMagic	New Image Technology
MacScan	New Image Technology
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ESIM	Niche Marketing
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FontShare	Olduvai Corp.
LaserAccellerator	Olduvai Corp.
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Xpress	Quark Inc.
Xtra	Quark Inc.
ColorScript 100	QMS, Inc.

JetScript Conversion Kit	QMS, Inc.
KISS	QMS, Inc.
KISS-plus	QMS, Inc.
PS-800 II	QMS, Inc.
PS-810	QMS, Inc.
PS-1500	QMS, Inc.
PS-2400	QMS, Inc.
PS-2700CK Conversion Kit	QMS, Inc.
QuadLaser PostScript	Quadram Corp.
Qume ScripTEN	Alcatel Qume
E/G Word	Qualitas Trading Co.
E/G Bridge	Qualitas Trading Co.
MusicPublisher	Saherazam
SAMNA Word III	SAMNA Corp
Fast Forms	Shana Enterprises Inc.
Netbridge	Shiva Inc.
NetModem V1200	Shiva Inc.
Accessory Pak 1	Silicon Beach Software, Inc.
Digital Darkroom	Silicon Beach Software, Inc.
Paint Cutter	Silicon Beach Software, Inc.
SuperPaint	Silicon Beach Software, Inc.
ScenicWriter	ScenicSoft, Inc.
Attika Greek	SMK
Greekeys	SMK
Publishing Partner Professional	Soft Logik Corp.
Chemintosh DA	SoftShell Co.
Graph Station	Software Clearing House, Inc.
Bodettes Borders	Software Complement
Cut Outs	Software Complement
Nouveau	Software Complement
Harvard Presentation Graphics	Software Publishing Corp.
PFS First Publisher	Software Publishing Corp.
Personal Publisher	Software Publishing Corp.
MacΣqn	Software for Recognition Technologies
MiniDraw	Software for Recognition Technologies
Suitcase	Software Supply
MicroPhone	Software Venutres
R-Server	Solana Electronics
I-Server	Solana Electronics
X-810	Solana Electronics
The Clipper	Solutions International
The Curator	Solutions International
SmartScrap	Solutions International
SuperGlue	Solutions International
The Font Buyers Guide	SourceNet
MacTransfer	Southeastern Software
Specific Fonts 3	Specific Solutions
Springboard Publisher	Springboard Software, Inc.
Electronic Clipart Digest	SSG Laserworks
Papermax 500	Sterling Computer
Click & Clip	Studio Advertising Art
DO-IT	Studio Software, Inc.
FrontPage	Studio Software, Inc.
TopDraw	StyleWare
PixelPaint	SuperMac Technologies
SuperLaserSpool	SuperMac Technologies
SuperMac I/O	SuperMac Technologies
More	Symantec Corp.
Q&A Write	Symantec Corp.
PictureBase	Symmetry Corp
HotShot	SymSoft
AppleWriter/ LaserWriter Utilities	Synergetics
Crystal Publishing System	Syntactics Corp.
T3 Scientific Word Processing System	TCI Software Research, Inc.
Laserletter Series	T/Maker
Bombay	T/Maker
Click-Art Effects	T/Maker
ClickArt Postscript Images	T/Maker
Plymouth	T/Maker
Scrapbook+	T/Maker
Seville	T/Maker
Write Now	T/Maker
Tandem T65-10, 20 & 30	Tandem Computing
TandyLink board	Tandy Corp.

LaserGraph	Tangent Technologies
LaserScript Plus	Tangent Technologies
LaserScript/S	Tangent Technologies
MacSpool	Tangent Technologies
PC MacBridge/MCA	Tangent Technologies
PC MacBridge Plus	Tangent Technologies
PCMacSpool	Tangent Technologies
PS Plot	Tangent Technologies
PS Print	Tangent Technologies
TangentShare	Tangent Technologies
TangentSpool Kit	Tangent Technologies
WinPrint	Tangent Technologies
Xris-Xros	Taylored Graphics
CommUnity-Mac	Technology Concepts Inc.
OmniLaser	Texas Instruments, Inc.
Live Image Publishing System	Texet Corp.
Paper Plus 500	The Laser Connection
PS Jet+	The Laser Connection
PS Jet+M	The Laser Connection
PSJet Postscript Memory Board	The Laser Connection
PageWriter	The 'Puter Group
The Typesetters Connection: Windows	The 'Puter Group
LaserSpeed	Think Technologies
3Server3 network server	3COM Corp.
3+	3COM
EtherLink/NB Card	3COM
IMAGESWITH IMPACT	3G Graphics
Thunderscan	Thunderware
TSSnet	Thursby Software
Publish-It	Timeworks
FlashCard	TOPS (A Sun Microsystems Company)
Graphics Plus	TOPS (A Sun Microsystems Company)
NetPrint	TOPS (A Sun Microsystems Company)
PC Macbridge ATB/MCA	TOPS (A Sun Microsystems Company)
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Publishers Paintbrush	ZSoft Corp.
Publishers Type Foundry	ZSoft Corp.

GLOSSARY

AppleShare Apple's file sharing hardware and software that enables multiple users to share applications and files.

AppleTalk The data transmission scheme used to communicate at relatively high (usually 230,400 *bits* per second) speed with the *PostScript* LaserWriters. Transmits data over a *LocalTalk* Cable System.

artwork The graphics portion (photographs or line art) of a document.

ascent line A horizontal line that corresponds to the height of the tops of the tallest *characters* in a *font.*

ASCII Stands for *American Standard Code for Information Interchange* and is pronounced "ask-ee." It is a set of numbers that represents the various alphanumeric text *characters* so they may be dependably transmitted between computers or *peripherals.*

base line A horizontal line corresponding to the bottom-most part of a set of *characters* in a *font.*

baud rate A unit of data transmission speed or the number of discrete data signal states per second. Usually, but not always, the same as bits per second, a measure of the *bit rate.*

bit The smallest unit of computer data, consisting of either a one or a zero.

bit-mapped An image made up of individual dots to form the design. The dots, in turn, are represented in the computer as bits. See *pixel.*

bit rate The speed at which bits are transmitted, usually expressed in bits per second or "bps."

body type A type size generally used for blocks of *text,* often 14-points or smaller. See *display type.*

boldface A modification of a *typeface* to make the *characters* heavier in weight by increasing their line or stroke thickness.

buffer A memory area or device that holds information until it can be processed. A printer buffer, for example, holds text and graphics until the printer can process it.

bullet A special *character*(•) used for emphasis when itemizing elements in a list. On the Macintosh it is entered by pressing Option-8.

byte A packet of eight *bits.*

cache See *font cache.*

camera-ready A printing master that is ready for offset reproduction. The LaserWriter is often used to produce camera-ready art and *layouts.*

CD-ROM Stands for "compact disk-read-only memory." A file of data on a compact disk that can be put into a computer, but data cannot be added to or stored on the compact disk.

character Any alphabetic or numeric figure.

Chooser The Macintosh's software menu for choosing the printing device to be used.

color separations A method of converting color art into separate colors for printing each color as a separate pass through the press.

Command key Apple's equivalent to the more familiar Control key used on other computers.

continuous tone Art that contains all levels of gray from black to white. A photograph is continuous tone.

controller The electronic portion of a *laser* printer that converts the computer's description of a page image into a *raster image* that can be "painted" onto the *laser* printer's light-sensitive imaging drum for printing. Also called a *raster-image processor* or RIP.

DB-9 connector A nine-pin connector with one row of five pins over a row of four pins. Used on the Macintosh 128, 512K, and 512KE models.

descent line A horizontal line representing the bottom descent of the lowest *characters* (lower case *p,* for example) extending below the *base line.*

desk accessory A program that can be used while another application is in use.

desktop publishing A personal computer-based system that provides the capability of producing masters for documents of publication quality.

DIN-8 connector A round, eight-pin connector used on the Macintosh SE and II.

display type A larger type size used for headings and headlines. See *body type.*

dot-matrix A printing method in which each *character* or *graphic* is formed by a pattern of dots, usually by mechanical impact with an inked ribbon.

download The process of sending a *font,* file, or document to another device.

dpi A unit for measuring *resolution* or degree of fineness of an image. Acronym for "*dots per inch.*"

driver A software program used to communicate with an input or output device. See *printer driver.*

em dash A long dash (—), the same width as a lower case letter *m.* Invoked from the Macintosh keyboard by pressing Option-Shift-hyphen.

emulation A manner of operating in which one system imitates the operation of another. For example, the LaserWriter II NTX emulates the Hewlett-Packard LaserJet+ and, therefore, will print documents from a LaserJet *printer driver.*

en dash A medium dash (–), the same width as a lower case letter *n.* Invoked from the Macintosh keyboard by pressing Option-hyphen.

Encapsulated PostScript See *EPSF.*

EPSF Encapsulated PostScript Format, a kind of *PostScript* file that also carries with it a *bit-mapped* representation to be displayed on the screen while the *PostScript* version of the image is used to drive the printer.

Ethernet A high speed networking system developed by Xerox, Intel, and Digital to link computers together.

EtherTalk A card added to a Macintosh SE or II to link it with an *Ethernet* system.

file server A mass storage device to hold documents for more than one computer.

firmware Programs or data that are stored in a permanent memory chip or *ROM*. They are built in by the equipment manufacturer. The resident *PostScript fonts* in the LaserWriter are examples of firmware.

font A specific set of *characters* in a single size and style. For example, 12-point Helvetica *italic* is a font. See *typeface*.

Font/DA Mover An application used to allow the addition or removal of *fonts* or *desk accessories* from the Macintosh System file.

font cache The holding in memory, either in *RAM* or on a *hard disk*, of the *bit-mapped* version of the *font* after being produced from the *PostScript* outline. This greatly speeds printing.

font scaling The enlargement or reduction of a *typeface* with little or no degradation in quality. Usually accomplished with typefaces that are in the form of outline shapes and mathematical scaling factors. *PostScript typefaces*, for example, are scaleable to an almost unlimited number of sizes.

graphics Information in the form of pictures or images.

gray scale A range of intensities or densities of gray in each dot of a scanned image rather than just black or white. Takes more memory than simple black and white bit-maps.

halftone The result of converting a photographic *continuous tone* image into a digitized form composed of *pixels* of varying sizes of black dots which appear to the eye as shades of gray. Used for printing values of gray on devices (printing presses, for example) that can print only in full black or full white.

hard disk A disk made of metal and sealed into a drive or cartridge. It is used for storing large amounts of data.

imagesetter A high *resolution* printing device that handles *text* and *graphics*. Thus, the entire *camera-ready layout* is produced in a typeset quality.

Installer An application that installs a newer version of System software, yet allows you to keep the previous version's installed *fonts* and *desk accessories* with the new version.

interface The point at which independent systems interact or communicate data.

italic A slanted *character* used to make words stand out.

justification Making the lines of *text* each the same length so that there are straight margins on both sides. Also called "full-flush." Can also describe partial justification, i.e., right justification or left justification.

kern A typographic term for moving *characters* together or further apart. Often used with certain pairs of letters to adjust or remove the extra white space between them.

LAN Acronym for *local area network.*

laser A very precise source of light that can be carefully controlled. In a laser printer, the beam of light "paints" the letters and graphics onto a light-sensitive drum prior to printing. An acronym for "light amplification by stimulated emission of radiation."

layout The basic design of the page showing the position of every element.

leading A typographic term for the amount of vertical space between the *descent line* and the *ascent line* of the next line of *text.* Pronounced "ledding."

LED An acronym for *light-emitting diode.*

light-emitting diode A solid state device that produces light when excited by an electric current. Used instead of a *laser* in some *PostScript* printers.

ligature A typographic term for a *text character* that combines two or more separate characters into a single symbol, e.g., œ.

line art *Graphics* composed of rules and other geometric elements as opposed to *halftones.*

local area network A group of computers hooked together for sharing data and peripherals.

LocalTalk Apple's trade name for its hardware wiring scheme for running the AppleTalk communication protocols. Previously called *AppleTalk,* but now that name has been reserved for the protocol and is not used for the hardware.

mechanical A complete page, ready to be reproduced. Also called *camera-ready.*

megabyte A unit of memory capacity equal to 2^{20}, or 1,048,576 *bytes.* Often rounded off to represent a million bytes.

microprocessor The computer chip that actually does the computing. It is the powerhouse that performs all the mathematical data functions that makes a computer work. The LaserWriters, except for the LaserWriter NTX,

use a *Motorola 68000* microprocessor, for example. The NTX uses the Motorola 68020.

MINI-8 connector A small, cylindrical connector. Used on *LocalTalk* cables to connect the Macintosh Plus, SE, and II. Usually called *DIN-8 connectors*. Earlier Macs use a *DB-9* 9-pin connector.

monospaced font Any *typeface* design in which the *character's* widths are the same. For example, Courier is a monospaced font. Most typewriters also use monospaced fonts. Also called "monopitch."

Motorola 68000 The *microprocessor* chip that powers the Macintosh Plus and SE and the LaserWriter, LaserWriter Plus, and LaserWriter NT models. It is a 16/32-*bit* chip: that is, it processes data inside in 32 *bit* packages, and sends it in and out 16 bits at a time.

Motorola 68020 The *microprocessor* chip that powers the Macintosh II and the LaserWriter NTX. It is a full 32-*bit* chip: that is, it processes data inside in 32 bit packages and also sends information in and out 32 bits at a time.

MS-DOS The operating system used on the IBM-PC, XT and AT models. Acronym for "Microsoft Disk Operating System." Called PC-DOS by IBM.

Namer An application that allows you to give a LaserWriter a specific name on an *AppleTalk network* system. Used so that the receiving printer can be specified by name.

network A data transfer system linking computers together usually with shared *peripherals* such as printers.

object-oriented A *graphic* that is mathematically described in terms of geometric shapes.

OCR Stands for "optical character recognition" and uses a *scanner* to read the *graphic* shape of *text characters* and make accurate judgements about the represented character. It then generates an *ASCII* code for that character which can be input into documents.

Option key A modifier key on the Macintosh used to enter special *characters* such as foreign letters and accents.

page description language Software that allows precise placement of every element, *text* and *graphics*, on a page so it may be reproduced with high accuracy from any device that interpretes that language. *PostScript* is a page description language.

parallel A method for sending data using an *interface* which transmits several *bits* of information (usually 8 bits or 1 *byte*) simultaneously, each over separate wires or channels.

PDL Acronym for *page description language.*

peripheral A device attached to a computer that communicates data with the computer, e.g., *hard disk*, modem, printer, *scanner.*

pica A typographic unit of measurement equal to 1/6 inch. There are 12 *points* in a pica.

PICT A universal format for the transfer of *graphic* images between Macintosh applications.

pixel An abbreviation for "picture element." It is the smallest element of *resolution* in an image. A pixel on the Macintosh screen is 1/72 inch. On the LaserWriters, it is 1/300 inch.

point A standard typographic unit of type size measurement equal to 1/72 inch.

port A socket on a computer where a *peripheral* device, a *network*, or another computer can be plugged in.

PostScript The *page description language (PDL)* developed by Adobe Systems Inc. and used to drive all of the Apple LaserWriters except the LaserWriter IISC. A PostScript interpreter inside the LaserWriter converts the PostScript code into *raster* scan data for sending to the *laser.* PostScript provides an accurate representation of the contents and placement of all elements on the page and the ability to scale and modify various *typefaces.*

printer driver A software program that actually does the sending of the data to the printer. In the Macintosh to LaserWriter, the printer driver is called "LaserWriter."

proof A hard copy used for checking the accuracy of the *text* and *layout* prior to the final reproduction job.

proportional font Any *typeface* design in which different *characters* have different widths. For example, the letter *m* is wider than a letter *i* in proportional typefaces. Most publishing typefaces are proportional and are faster and more pleasant to read.

QuickDraw An extensive collection of *graphics* routines built into the Macintosh *ROM.*

ragged Lines of type that do not begin or end at the same position. Ragged right is a common format for *text.*

RAM The memory available for reading and writing data. Sometimes called "volatile" memory because it is destroyed when the computer is turned off. Stands for "random access memory."

raster A back-and-forth "painting" of an image. Television pictures are raster scanned, for example.

raster image processor The hardware/software combination inside the LaserWriter that translates the *PostScript* commands governing *text* and *graphics* into a sequence of dots or *bit-map* that, in turn, controls the *laser's* firing to "paint" the image back and forth across the light-sensitive imaging drum.

reset The act of clearing the memory of a device, often by turning the power switch off and then on again.

resolution A measure of the quality of an image, usually measured in dots per inch or *dpi.*

resolution independent A description that doesn't depend on the printing quality of the output device.

ROM The memory available for reading out data, but not available for writing in new data by the user. The LaserWriter's built-in *typeface* designs are contained in ROMs. Sometimes called "permanent" memory or *firmware.* It remains intact when the computer is turned off.

roman A style of letters with upright main strokes.

RS-232C Any cable that is wired in accordance with the RS-232C standard. It is the most common *serial* communication standard.

rules Lines used to divide or border a page.

sans serif Without *serifs. Serifs* are the fine lines that finish off the main strokes of an alphabetic *character.* A sans-serif *typeface* uses strokes that are predominately one thickness.

scalable font A *typeface* design that is capable of being enlarged or reduced with little or no degradation in quality. Usually in the form of outline shapes and mathematical scaling factors. *PostScript* typefaces, for example, are scalable.

scanner An image input device that scans a text page, drawing, or photograph and converts it to digital data.

screen font A *bit-mapped* version of the *typeface* used to represent the actual typeface on the computer's screen. Since it is bit-mapped, its appearance will severely degrade when scaled to different sizes.

SCSI A high speed computer *interface* capable of connecting multiple *peripherals*. Often used to connect *hard disks, scanners*, and non-PostScript laser printers. Acronym for "small computer system interface" and pronounced, "SKUH-zee."

serial A method for sending data using an *interface* which transmits data *bytes* of information in sequential order, one after the other, a bit at a time over a single wire or channel.

serif Serifs are the fine lines that finish off the main strokes of an alphabetic *character*. For example, the feet on the bottom of horizontal strokes of a capital letter M in a Times roman *typeface*.

smoothing A printer effect that improves the appearence of *bit-mapped graphics* and *fonts*.

spooler Software that creates a special disk file of a document to be printed which can then be fed to the printer as required. Allows printing to take place while you continue working on something else. Also called "background printing."

style A stylistic variation of a *typeface*, such as *italic*, bold, underline, shadow, or outline.

system font A *typeface* built into the Macintosh that is used to display menus and messages on the screen. System *fonts* cannot be removed or altered.

text Information presented in the form of readable alphanumeric *characters*.

TIFF Acronym for "Tagged Image File Format." A file type used for scanned images that translates the *gray scale* information into commands that form a *bit-mapped* image that can be printed on black-white devices.

toner A powdered ink that can be melted or "fused" to the paper by a combination of heat and pressure. Toner makes the black image on a printout from the LaserWriter.

toner cartridge The replaceable container for the *toner* and the light-sensitive imaging drum used to form the page's image before printing.

typeface A generic set of *characters*, including all styles and sizes. For example, Helvetica is a typeface or typeface family. See *font*.

typesetter A high *resolution* printing device that handles *text*. Thus, to create a *camera-ready layout*, the type must be cut and pasted into a *layout* complete with added *graphics*. See *imagesetter*.

typestyle A *typeface* in a certain style. For example, Helvetica bold.

UNIX A multi-user operating system developed by Bell Labs that allows multiple users to access shared applications. Used primarily in universities and research labs.

WYSIWYG Acronym for "What you see is what you get" (pronounced "WIZZY-wig"). It means that the screen image matches the printed output as closely as possible.

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Inside The Apple LaserWriter

"A great book for the layperson who wants to understand more about our printers. Roger has an uncanny ability to express very technical ideas in a very clear and unintimidating way."
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- descriptions of other PostScript printers with comparisons to the LaserWriter

LaserWriters are a worthwhile (and hefty) investment. **Inside the Apple LaserWriter** shows you how to protect and maximize that investment while getting superior performance from this exciting line of printers.

Roger Hart has published over sixty magazine articles and won four writing awards from The Society for Technical Communication. His work has appeared in *Publish, Macweek, A+, InCider, Macintosh Buyer's Guide, Computer Buyer's Guide and Handbook, Business Computing, Macazine, InfoWorld,* and numerous other magazines. He is a contributing editor to *Family and Home Office Computing* magazine and a member of the *InfoWorld* Review Board. Mr. Hart lives in Merrimack, New Hampshire.

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