**Chapter 4B: Printing**

**Overview:**

Most computer users can’t imagine working without a printer. Printer can give us something that we can touch, carry, and share with others. Printed documents are essential in most work places, where people must share reports, budgets, memos, and other types of information.

Over the past decade, the variety of available printing devices has exploded; however, three types of printers have become the most popular: dot matrix, ink jet, and laser. Within those three groups, consumers have hundreds of options, ranging widely in price and features. Several other types of special printing devices are available for users with special needs, such as large-format printouts or images with extremely accurate color and high resolution.

This lesson introduces us to the basics of hard-copy output devices. You will learn about the most common types of printers and see how each creates an image on paper. You will learn he criteria for evaluating different printers and examine some of the specialized printing designed for professional use.

**Objectives:**

* List the three most commonly used types of printers.
* List the four criteria you should consider when evaluating printers.
* Describe how a dot matrix printer creates an image on a page.
* Explain how an ink jet printer creates an image on a page.
* Explain how a laser printer creates on a page.
* List four types of high-quality printing devices commonly used in business.

**Commonly used Printers**

Besides the monitor, the other important output device is printer. Generally, printers fall into two categories: impact and nonimpact. An **impact printer** creates an image by using pins or hammers to press an inked ribbon against the paper. A simple example of an impact printer is a typewriter, which uses small hammers to strike the ribbon. Each hammer is embossed with the shape of a letter, number, or symbol; that shape is transferred through the inked ribbon onto the paper, creating a printed character.

Although it is seldom done today, many modern electric typewriters can be connected to a PC and used as a letter-quality printer. As a printer, however, even a good typewriter is slow and limited in the kinds of documents it can produce. The most common type of impact printer is the dot matrix printer. Other types of impact printers are line printers and band printers.

**Nonimpact printers** use other means to create an image. Ink jet printers, for example, use tiny nozzles to spray droplets of ink onto the page. Laser printers work like photocopiers, using heat to bond microscopic particles of dry toner to specific parts of the page.

In the early years of computing, dot matrix printers were the most commonly used printing devices. They are not as prevalent now, although dot matrix printers are still popular in business and academic settings because they are relatively fast and inexpensive to operate, and they do a good job of printing text and simple graphics. Ink jet printers now offer much higher quality for about the same price, and they have become more popular than dot matrix printers in homes and small businesses. Laser printers are also popular in homes and businesses, but they are more expensive to buy and operate than either ink jet or dot matrix devices.

**Dot Matrix Printers**

**Dot matrix printers** are commonly used in workplaces where physical impact with the paper is important, such as when the user is printing to carbon copy or pressure-sensitive forms, these printers can produce sheets of plain text very quickly. They also are used to print very wide sheets, as data processing departments often use when generating large reports with wide columns of information.

A dot matrix printer creates an image by using a mechanism called a **print head**, which contains a cluster (or matrix) of short pins arranged in one or more columns. On receiving instructions from the PC, the printers can push any of the pins out in any combination. By pushing out pins in various combinations, the print head can create alphanumeric characters.

When pushed out from the cluster, the protruding pins’ ends strike a ribbon, which is held in place between the print head and the paper. When the pins strike the ribbon, they press ink from the ribbon onto the paper.

The more pins that a print head contains, the higher the printer’s resolution. The lowest resolution dot matrix printers have only nine pins; the highest resolution printers have 24 pins.

The speed of dot matrix printers is measured in **characters per second (**cps**).** The slowest dot matrix printers create 50-70 characters per second; the fastest print more than 500 cps.

Although dot matrix printers are not commonly used in homes; they are still widely used in business, as are the other types of impact printers:

* Line Printers are a special type of impact printer. It works like a dot matrix printer but uses a special wide print head that can print an entire line of text at one time. Line printers do not offer high resolution but are incredibly fast; the fastest can print 3,000 lines of text per minute.
* Band Printers are features a rotating band embossed with alphanumeric characters. To print a character, the machine rotates the band to the desired character, and then a small hammer taps the band, pressing the character against a ribbon. Although this sounds like a slow process, band printers are very fast and very robust. Depending on the character set used, a good-quality band printer can generate 2,000 lines of text per minute.

**Ink Jet Printers**

Ink jet printers create an image directly on the paper by spraying ink through tiny nozzles. The popularity of ink jet printers jumped around 1990 when the speed and quality improved and prices plummeted. Today, good ink jet printers are available for less than $100. These models typically attain print resolutions of at least 300 dots per inch. These same models can print from two to four pages per minute (only slightly slower than the slowest laser printers).

Compared to laser printers, the operating cost of an ink jet printer is relatively low. Expensive maintenance is rare, and the only part that needs routine replacement is the ink cartridge, which ranges in price from $20 to $35. Many ink jet printers use one cartridge for color printing and a separate black-only cartridge for black-and-white printing. This feature saves money by reserving colored ink only for color printing.

Color ink jet printers have four ink nozzles: cyan (blue), magenta (red), yellow, and black. For this reason, they are sometimes referred to as CMYK printers, or as using the CMYK color process. These four colors are used in almost all color printing because it is possible to combine them to create any color. Notice that the colors are different from the primary additive colors (red, green, and blue) used in monitors. Printed color is the result of light bouncing off the paper, not color transmitted directly from a light source. Consequently, cyan magenta, yellow, and black are sometimes called subtractive colors and color printing is sometimes called four-color printing. When used with special printing paper, many ink jet printers can produce photo-quality images. For this reason, they are often used to print pictures taken with a digital camera.

**Laser Printers**

Laser printers are not more expensive than ink jet printers, their print quality is higher, and most are faster. As their name implies, a laser is at the heart of these printers. A CPU and memory are built into the printer to interpret the data that it receives from the computer and to control the laser. The result is a complicated piece of equipment that uses technology similar to that in photocopiers. The quality and speed of laser printers make them ideal for office environment, where several users can easily share the same printer via a network.

Just as the electron gun in a monitor can target any pixel, the laser in a laser printer can aim at any point on a drum, creating an electrical charge. Toner, which is composed of tiny particles of ink, sticks to the drum in the places the laser has charged. Then, with pressure and heat, the toner is transferred off the drum onto the paper. The amount of memory that laser printers contain determines the speed at which documents are printed.

A color laser printer works like a single-color model, except that the process is repeated four times and a different toner color is used for each pass. The four colors used are the same as in the color ink jet printers: cyan, magenta, yellow, and black.

Single-color (black) laser printers typically can produce between 4 and 16 pages of text a minute. If you are printing graphics, the output can be a great deal slower. The most common laser printers have resolutions of 300 or 600 dpi, both horizontally and vertically, but some high-end models have resolution of at least 1,200 dpi for top-quality professional printing. It is difficult to detect the difference between text printed at 600 dpi and at 1,200 dpi; the higher resolution is most noticeable in graphics reproduction such as photographs and artwork.

Laser printers start at about $150, and the price increases dramatically along with speed and resolution. Color laser printers are considerably more expensive than single-color printers. In addition, laser printers require new toner cartridges after a few thousand pages, and toner cartridges can cost anywhere from $40 t0 $200.

**All-in-One Peripherals**

Several printers makers now use ink jet printers as the basis for all-in-one peripherals. These devices combine printing capabilities with scanning, photocopying, and faxing capabilities. Small, lightweight, and easy to use, all-in-one devices are popular in home offices and small businesses, among users who cannot afford to buy several professional-quality devices for these tasks.

All-in-one peripherals are available in black-and-white and color models, at prices as low as $200. Laser-based models are significantly more expensive that ink jet models, especially when color printing is required.

**Comparing printers**

When you are ready to buy a printer, you must consider how you plan to use it. Do you need to print only text, or are graphics capabilities also important? Do you need to print in color? Will you need to print a wide variety of fonts in many sizes? How quickly do you want your documents to be printed?

When evaluating printers, four additional criteria are important:

* **Image Quality** also known as print resolution is usually measured in dots per inch (dpi). The more dots per inch a printer can produce, the higher its image quality. For example, most medium-quality ink jet and laser printers can print 300 or 600 dots per inch, which is fine for most daily business applications. If a printer’s resolution is 600 dpi, this means it can print 600 columns of dots and 600 rows of dots in each square inch of the page, a total of 360,000 dots (600 \* 600 = 360,000). Professional-quality printers, used for creating colorful presentations, posters, or rendering, offer resolutions of 1,800 dpi or even higher.
* **Speed** is a measured in the number of pages per minute (ppm) the device can print. Most printers have different ppm ratings for text and graphics because graphics generally take longer to print. As print speed goes up, so does cost. Most consumer-level laser printers offer print speeds of 6 to 8 ppm, but high- volume professional laser printers can exceed 50 ppm.
* **Initial Cost** the cost of new printers has fallen dramatically. It is possible to buy a good-quality ink jet printer for personal user for less than $100; low-end laser printers can be found for less than $200. Professional-quality, high output systems can range in price from $1,000 to tens of thousands of dollars. Color printers always cost more than black-and-white printers, and this is especially true or laser printers.
* **Cost Operation** the cost of ink or toner and maintenance varies with the type of printer. Many different types of printer are available, too, and the choice can affect the cost of operation. Low-quality recycled paper, for example, is fine for printing draft-quality documents and costs less than a penny per sheet. Glossy, thick, photo-quality stock, used for printing photographs, can cost several dollars per sheet depending on size.

**High-Quality Printers**

Although most offices and homes use ink jet or laser printers, other types of printers are used for special purposes. These printers are often used by publishers and small print shops to create high-quality output, especially color output. The last type discussed in this section, the plotter, is designed specifically for printing large-format construction and engineering documents.

**Photo Printers**

With digital cameras and scanners becoming increasingly popular, users want to be able to print the images they create or scan. While the average color ink jet or laser printer can handle this job satisfactorily, many people are investing in special photo printers. Many photo printers use ink jet technology, but a few use dye-sublimation technologies. The best photo printers can create images that look nearly as good as a photograph printed using traditional methods.

Photo printer’s work slowly; some can take two to four minutes to create a printout. Several models create prints no longer than a standard 4 x 6-inch snapshot, although newer photo printers can produce 8 x 10-inch or even 11 x 14-inch prints. Many larger-format photo printers can print multiple images on a single sheet of paper. Whether you own a $50 dot matrix printer or a $5,000 color laser printer, you want to get the most from your investment. Although todays’ printers are much more durable than those of a decade ago, they still work better and last longer if they are properly maintained. Luckily, most consumer grade printers are easy to take care of. Here are some tips that will help you get years of service from your printer, no matter what kind of device it is.

**Getting Basic Information**

When maintaining your printer, the best place to start is the owner’s manual. Check it for specific instructions on setting up, cleaning, clearing out paper jams, replacing components, and other maintenance-related tasks. You may be able to find these instructions on the manufacturer’s web site.

Always unplug your printer and let it cool down completely before doing any maintenance or cleaning. All printers-especially units that are used a lot-get hot inside, possibly hot enough to burn you. To avoid shock, disconnect the printer’s cable from your computer or network. Also, be sure to remove the paper from the printer before working on it.

**Positioning a Printer**

Make sure your printer has room to breathe. This means setting up so there is space around it, to allow air to flow through the printer. This keeps down dust and avoids overheating. Avoid crowding objects (such as attacks of books or boxes) around the printer, you may block air flow. Never stack anything on top of a printer; the weight can cause malfunctions.

**Cleaning a Printer**

Printers usually don’t require heavy cleaning, but paper dust and airborne particles can collect inside a printer, adding to heat-build-up and leading to mechanical problems. You can clean the outside surfaces of most printers with a dry or damp cloth, but don’t use solvents or spray cleaners, which may be harmful to some printer parts.

To clean the inside of the printer, open it up and remove all paper. Remove the toner cartridge, ink cartridge, or ribbon as your owner’s manual directs. Use a lint-free-cloth or swabs to gently remove built-up dust and dirt. Do not use a we cloth, and never spray any kind of liquid cleaner into your printer unless the manufacturer recommends doing so.

If the printer has a great deal of dust built up inside, you can use a vacuum cleaner with a narrow nozzle to pull out the dust. If dust appears to be stuck or is embedded in tiny spaces, use a can of compressed air to blast it loose, then vacuum it out.

**Dealing with Paper Jams**

For years, paper jams have been the scourge of computer users. They strike at the worst times, and can take a long time to clear out. The best way to solve is to prevent it:

* Make sure your paper is compatible with your printer. Some ink jet printers, for example, do not work, well with thick, glossy paper. Check your manual to see what weights and sizes of paper will work best with your printer.
* Set the printer on an even, level surface. Tilting can encourage paper jams.
* Don’t overfill the paper tray. Paper must be flat and able to slide freely through the mechanism. If the tray is crammed with paper, the sheets may be buckled or stuffed in too tightly to move.

If you experience a paper jam, see your owner’s manual for instructions on clearing it. If paper jams are common problems. Contact the manufacturer for help.

**Plotters**

A plotter is a special kind of output device. It is like a printer because it produces images on paper, but the plotter is typically used to print large-format images, such as construction drawings created by architect.

Early plotters were bulky, mechanical devices that used robotic arms, which literally drew the image on a piece of paper. Table plotters (or flatbed plotters) use two robotic arms, each of which holds a set of colored ink pens, felt pens, or pencils. The two arms work in concert, operating at right angles as they draw on a stationary piece of paper. In additional to being complex and large (some are almost as big as a billiard table), table plotters are notoriously slow; a large, complicated drawing can take several hours to print.