Chapter 16 Basic Printer Concepts

◆ The second most common type of output device used with personal computers

◆ This chapter introduces the three types of character printers dot matrix, inkjet, and laser printers.

◆ The basic structures and operation of all three types of printers will be discussed.

◆ examines the different types of connection ports and interfaces used with these printers

PRINTER TYPES

◆ Impact printers place characters on the page by causing a hammer device to strike an inked ribbon. The ribbon, in turn, strikes the printing surface (paper).

◆ non-impact methods

■ Older, non-impact printers relied on special heat-sensitive or chemically reactive paper to form characters on the page.

■ Currently, the most popular non-impact printers use ink-jet or laser technologies to deliver ink to the page.

2 Methods 4 creating characters

◆ *fully formed character :* places a character on the page that is fully shaped, and fully filled in.

◆ *dot-matrix character :* This method involves placing dots on the page in strategic patterns to fool the eye into seeing a character.

FONTS

◆ refers to variations in the size and style of characters.

◆ There are three common methods of generating character fonts:

- *bitmapped (or raster-scanned fonts)*
- *vector-based*
- *TrueType outline fonts.*

Bitmapped fonts

◆ It store dot patterns for all the possible size and style variations of the characters in the set.

◆ Font styles refer to the characteristics of the font, such as normal, bold, and italic styles.

◆ Font size refers to the physical measurement of the character. Type is measured in increments of 1/72 of an inch. Each increment is referred to as a point. Common text sizes are 10-point and 12-point type.

Vector-based fonts

- *Vector-based fonts store the outlines of the character styles and sizes as sets of mathematical formulas.*

- *Each character is composed of a set of reference points and connecting lines between them. fonts can be scaled up and down to achieve various sizes.*

- *The approach requires much less storage space to store a character set and all of its variations than would be necessary for an equivalent bitmapped character set.*

- *In addition, vector-based fonts can be scaled and rotated; bitmapped fonts typically cannot be scaled and rotated. Conversely, bitmapped characters can be printed out directly and quickly, but vector-based characters must be generated when called for.*

TrueType fonts

- TrueType fonts are a newer type of outline fonts commonly used with Microsoft Windows. These fonts are stored as a set of points and outlines used to generate a set of bitmaps. Special algorithms adjust the bitmaps so that they look best at the specified resolution.

- After the bitmaps have been created, Windows stores them in a RAM cache that it creates. In this manner, the font is only generated once when it is first selected. Afterward, the fonts are just called out of memory, thus speeding up the process of delivering them to the printer. Each TrueType character set requires an FOT and a TTF file to create all of its sizes and resolutions.

PRINTER MECHANICS

◆ During the printing operation, the print mechanism must be properly positioned over each character cell in sequence. In most printers used with PCs, the character positioning action involves holding the paper stationary and stepping the print-head carriage across the page.

◆ The *print-head carriage rides on rods* that extend across the front of the page.

◆ In addition to positioning the print mechanism for printing, all printer types must feed paper through the print area. The type of *paper handling mechanism in a printer is somewhat dependent on* the type of forms that will be used with the printer and its speed.
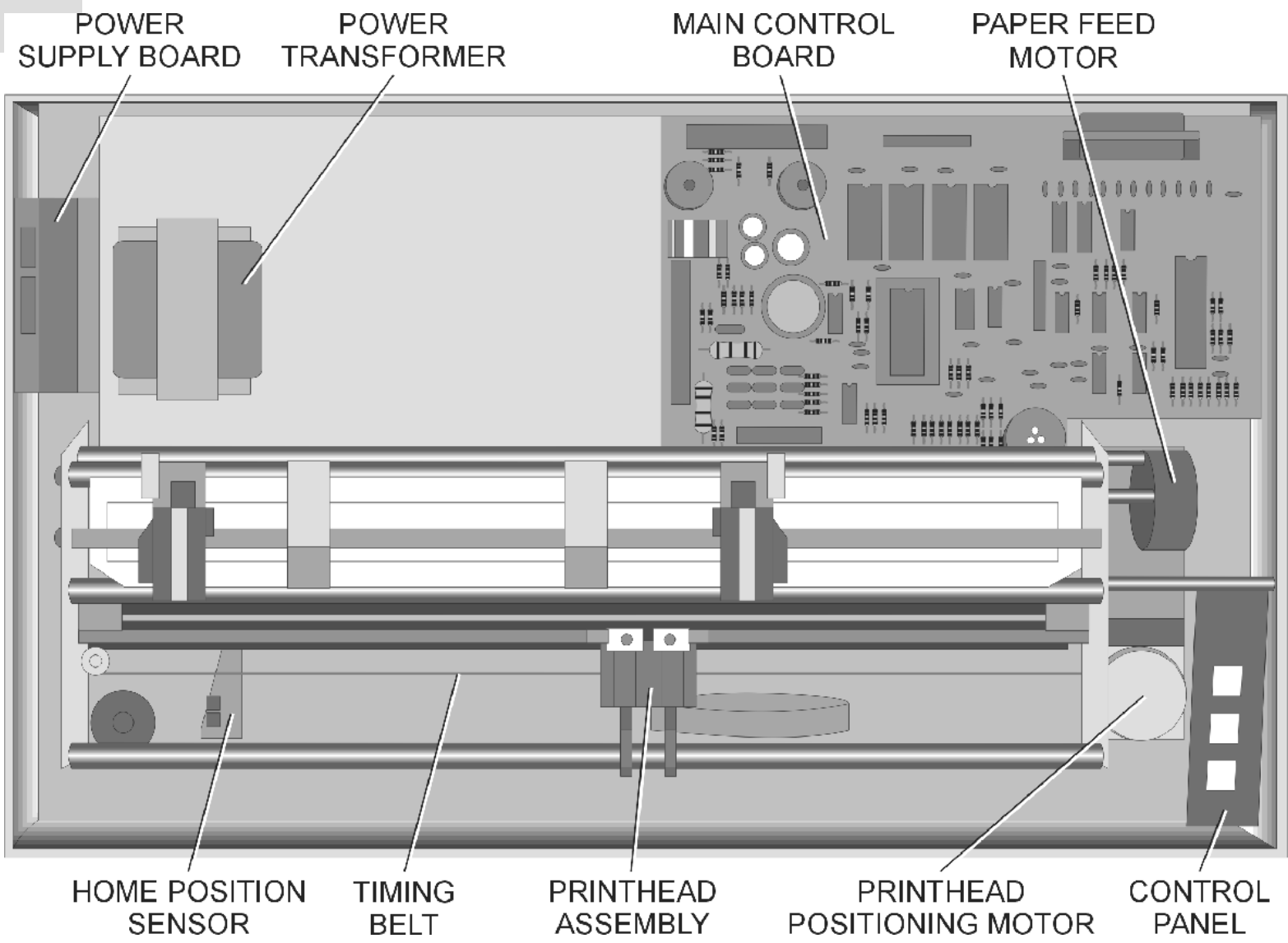
Paper Moving

◆ There are two common methods of moving paper through the printer:

◆ *Friction-feed—Uses friction to hold the paper against the* printer's platen. The paper advances through the printer as the platen turns.

◆ *Pin-feed—Pulls the paper through the printer by a set of pins* that fit into the holes along the edge of the form, as shown in Figure. The pins can be an integral part of the platen or mounted on a separate, motor-driven tractor.

A tractor/pin-feed mechanism.

SPROCKET COVERS

SPROCKET PINS

PLATEN
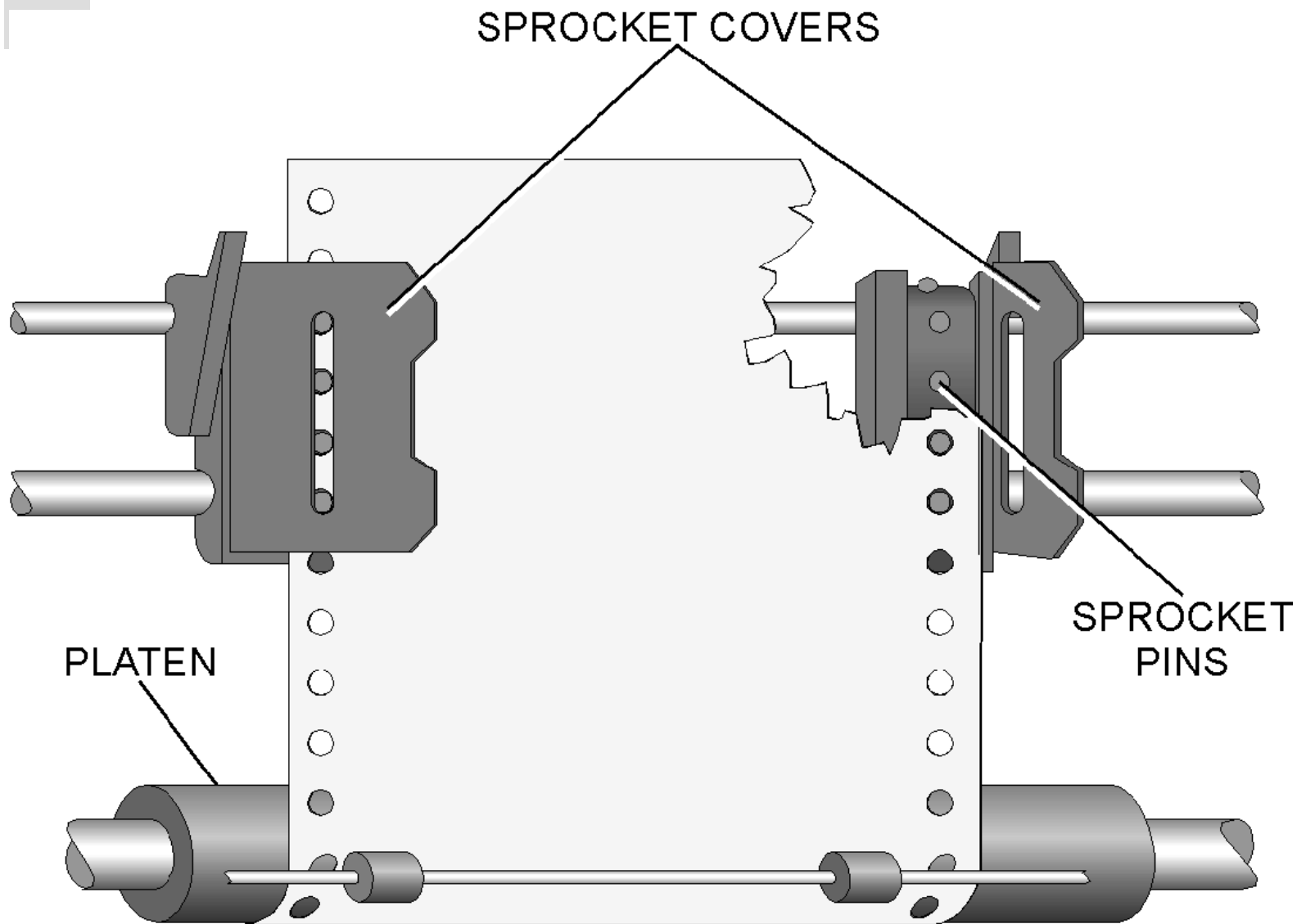
DOT-MATRIX PRINTERS

- Dot-matrix characters are not fully formed characters. Instead, its printed in the form of dot patterns that represent the characters. The reader's eye fills in the gaps between the dots.

- The print-head in a dot-matrix printer is a vertical column of *print wires controlled by electromagnets. Dots are created on the paper by* energizing selected electromagnets, which extend the desired print wires from the *print-head.*

- *In the print-head, the permanent magnet* keeps the wires pulled in until electromagnets are energized, causing them to move forward. The print wires impact an *ink ribbon, which* impacts the paper. Remember that the entire character is not printed in a single instant of time—it is printed in steps.

POWER SUPPLY BOARD · POWER TRANSFORMER · MAIN CONTROL BOARD · PAPER FEED MOTOR · HOME POSITION SENSOR · TIMING BELT · PRINTHEAD ASSEMBLY · PRINTHEAD POSITIONING MOTOR · CONTROL PANEL

INK-JET PRINTERS

◆ Characters are produced by squirting تدفقa precisely controlled stream of ink drops onto the paper. The drops must be controlled very precisely in terms of their aerodynamics, size, and shape, or the drop placement on the page becomes inexact, and the print quality falters.

◆ The drops are formed by one of two methods:-

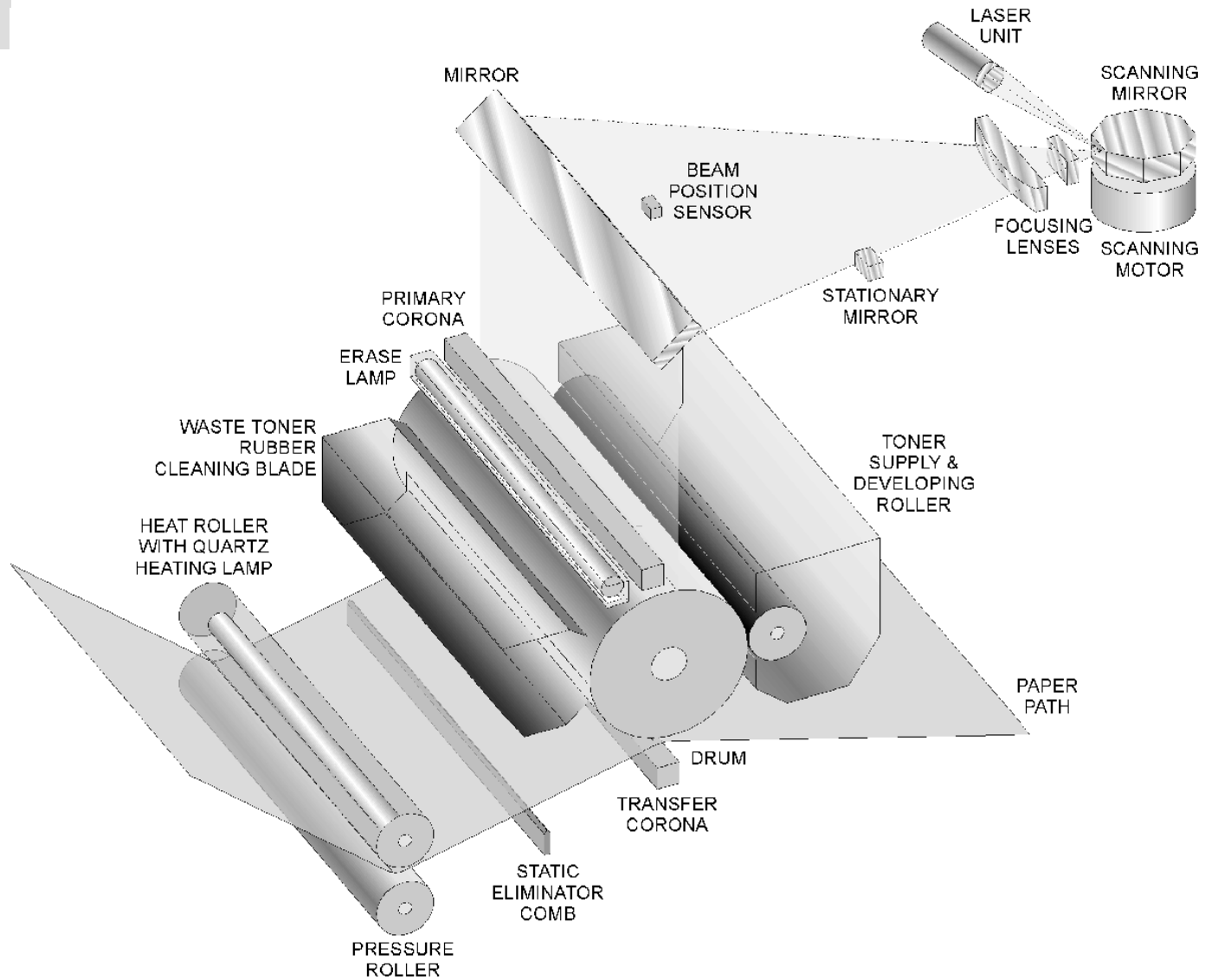● *Thermal shock*

● *Mechanical vibration*

Drop Forming

- *Thermal shock—Heats the ink in a capillary tube, just behind the nozzle. This increases the pressure of the ink in the tube and causes it to explode through the opening.*

- *Mechanical vibration—Uses vibrations from a piezoelectric crystal to force ink through a nozzle.*

- *The ink-jet nozzle is designed to provide the proper shape and trajectory for the ink drops so that they can be directed precisely toward the page.*
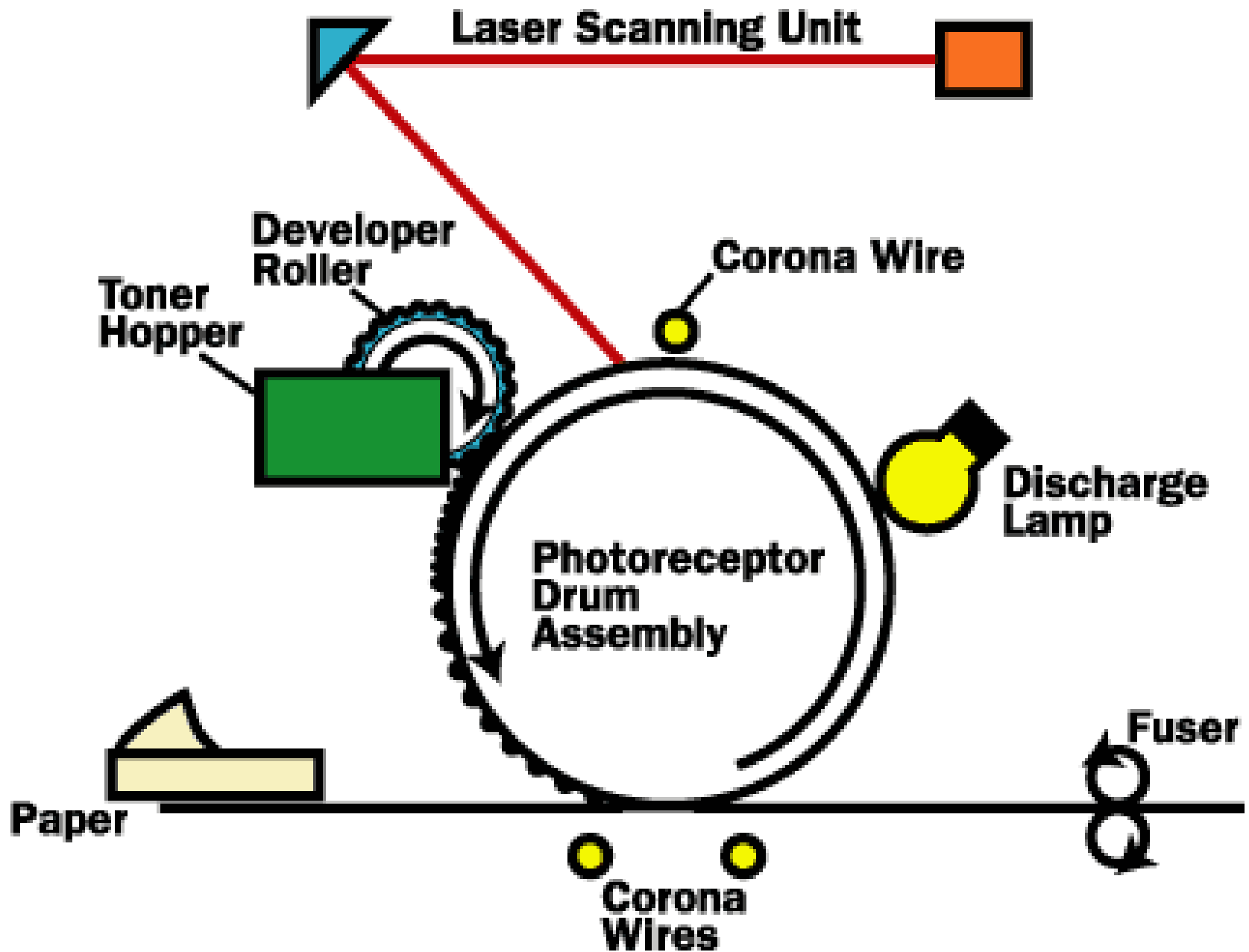
LASER PRINTERS

◆ The laser printer modulates a highly focused laser beam to produce CRT-like raster-scan images on a rotating drum, as depicted in Figure. This process was developed by Xerox and is referred to as *electro-photographic reproduction.*
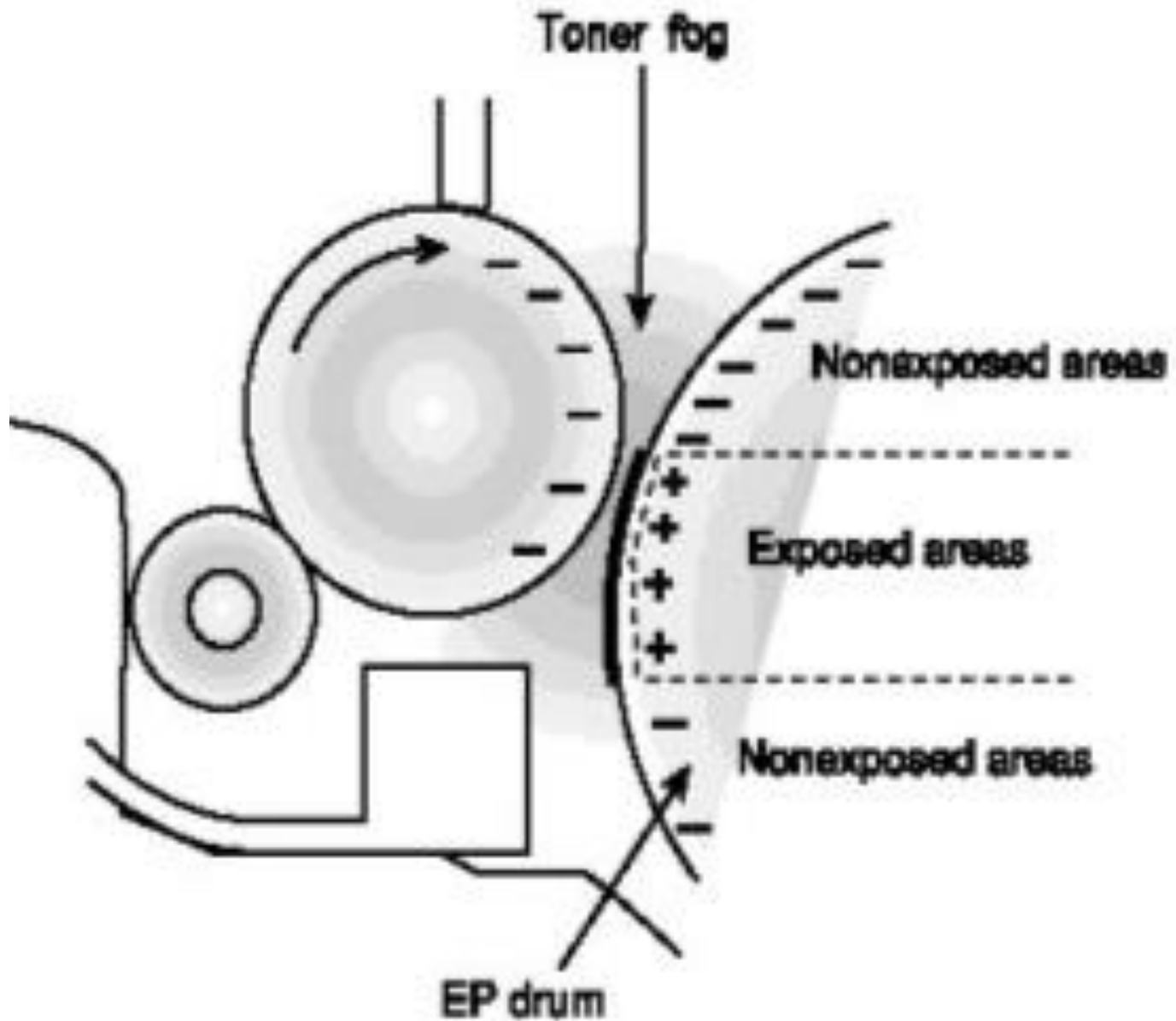
Laser Printer

LASER UNIT

SCANNING MIRROR

MIRROR

BEAM POSITION SENSOR

FOCUSING LENSES

SCANNING MOTOR

PRIMARY CORONA

STATIONARY MIRROR

ERASE LAMP

WASTE TONER RUBBER CLEANING BLADE

TONER SUPPLY & DEVELOPING ROLLER

HEAT ROLLER WITH QUARTZ HEATING LAMP

PAPER PATH

DRUM

TRANSFER CORONA

STATIC ELIMINATOR COMB

PRESSURE ROLLER

Laser Scanning Unit

Developer Roller

Corona Wire

Toner Hopper

Discharge Lamp

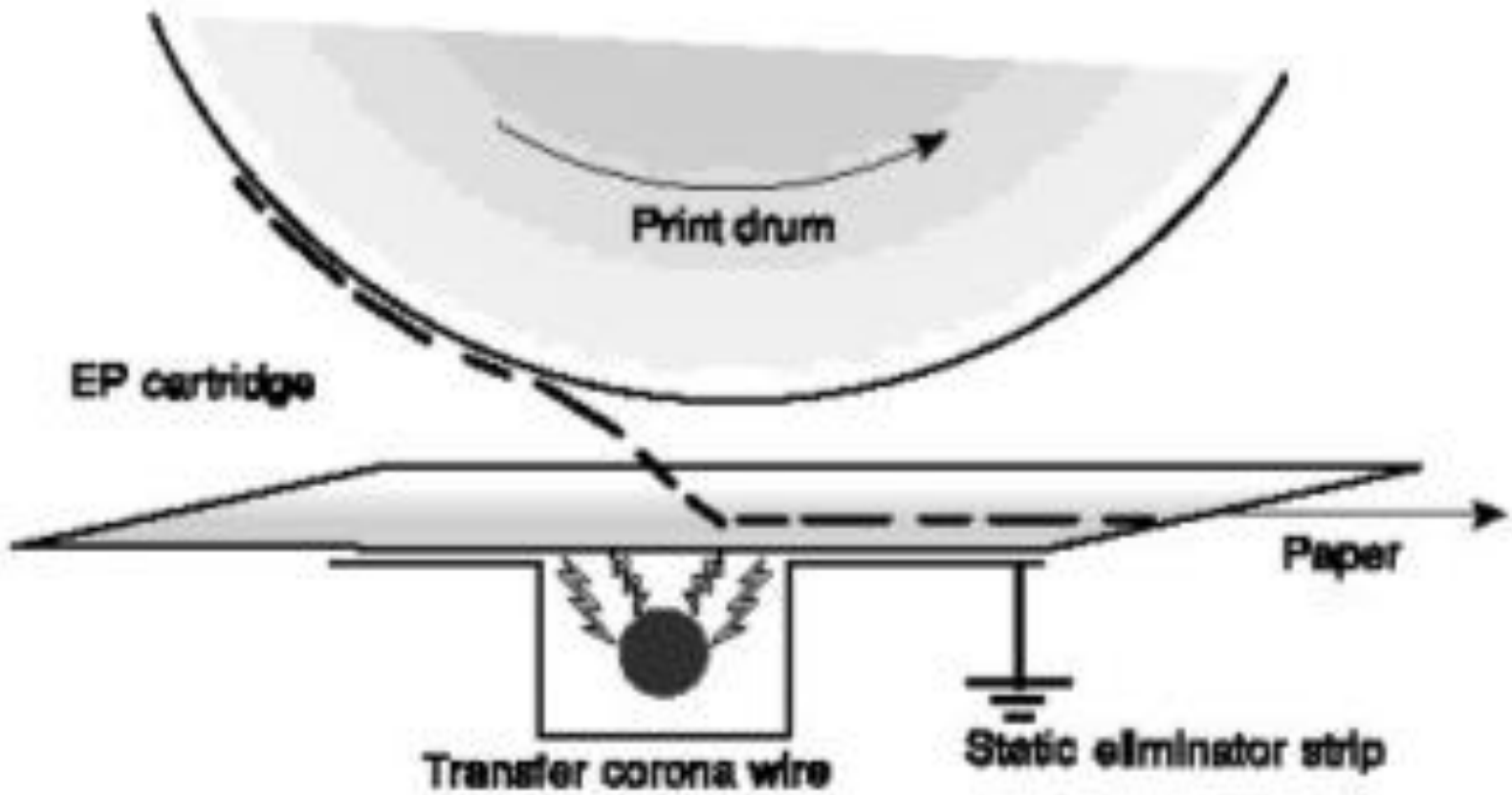Photoreceptor Drum Assembly

Fuser

Paper

Corona Wires

Electro-photographic reproduction

- The drum is coated with a *photosensitive plastic, which is given a* negative electrical charge over its surface. The modulated laser beam creates spots on the rotating drum.

- The spots written by the laser take on a positive electrical charge. A negatively charged toner material is attracted to the positively charged, written areas of the drum.

- The paper is fed past the rotating drum, and the toner is transferred to the paper. A pair of compression rollers and a high-temperature lamp work together to fuse the toner to the paper. Thus, the image, written on the drum by the laser, is transferred to the paper.

Toner fog

Nonexposed areas

Exposed areas

Nonexposed areas

EP drum

Print drum

EP cartridge

Paper

Transfer corona wire

Static eliminator strip

Laser Printing Operations

◆ The six stages of operation in a laser printer include

1. Cleaning
2. Conditioning
3. Writing
4. Developing
5. Transferring
6. Fusing

registration

- *When character data is received from the host computer, it is converted into a serial bit stream, which is applied to the scanning laser.*

- *The photosensitive drum rotates as the pulse encoded laser beam is scanned across it. The laser creates a copy of the image on the photosensitive drum in the form of a relatively positive-charged drawing.*

- *This operation is referred to as registration.*

◆ *Before the laser writes on the drum, a set of erase lamps shine on the drum to remove any residual traces of the preceding image. This leaves the complete drum with a neutral electrical charge. A high voltage, applied to the primary corona wire, creates a highly charged negative field that conditions the drum to be written on by applying a uniform negative charge (-600V) to it.*
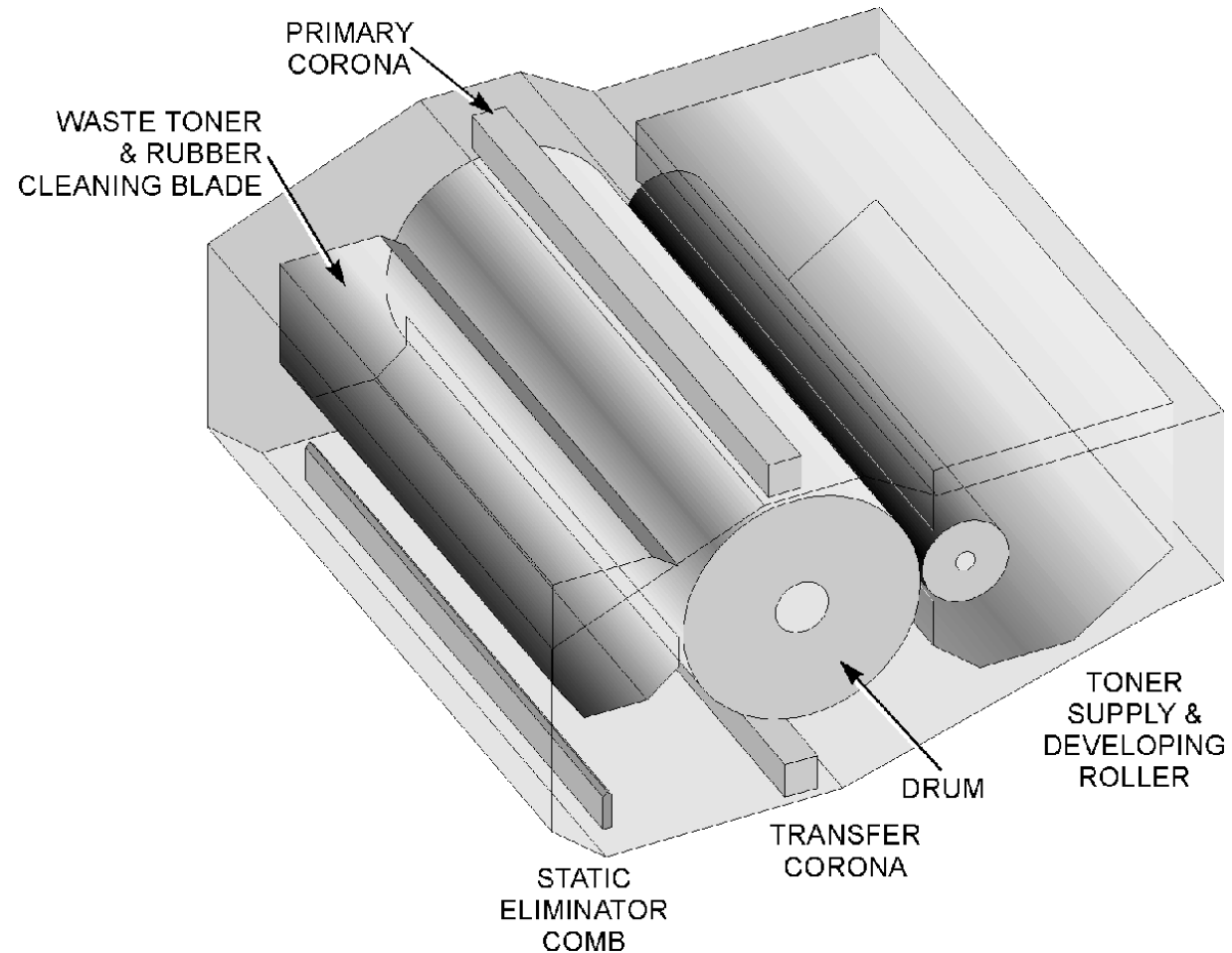
Toner

- *As the laser writes on the drum, the drum turns through the toner powder, which is attracted to the charged image on the drum.*

- *Toner is a very fine powder, bonded to iron particles that are attracted to the charges written on the drum. The developer roller in the toner cartridge turns as the drum turns and expels مطردa measured amount of toner past a restricting blade. A regulating AC voltage assists the toner in leaving the cartridge, but also pulls back some excess toner from the drum. Excess toner is recycled within the toner cartridge so that it can be used again.*

- *The transfer corona wire (transfer roller) is responsible for transferring the toner from the drum to the paper. The toner is transferred to the paper because of the highly positive charge the transfer corona wire applies to the paper. The positive charge attracts the negative toner particles away from the drum and onto the page.*

- *A special static eliminator comb acts to prevent the positively charged paper from sticking to the negatively charged drum.*

- *After the image has been transferred to the paper, a pair of compression rollers, in the fusing unit (fuser), act to press the toner particles into the paper while they melt them to it .*

- *A thermal sensor in the fusing unit monitors the temperature of the unit. This information is applied to the control circuitry so that it can control the fuser temperature between 140°C and 230°C.*

Electro photographic Cartridges

◆ *This cartridge contains the toner supply, the corona wire, the drum assembly, and the developing roller.*

PRIMARY CORONA

WASTE TONER & RUBBER CLEANING BLADE

TONER SUPPLY & DEVELOPING ROLLER

DRUM

TRANSFER CORONA

STATIC ELIMINATOR COMB

Printer Cables

◆ *One note of caution concerning parallel printer cables: The IEEE has established specifications for bi-directional parallel-printer cables (IEEE 1284).*

◆ *The recommended signal cable lengths associated with parallel and serial printers are :*

◆ *Standard Parallel Printers—0-10 feet (3 meters), although some equipment manufacturers specify 6-feet (1.8 meters) maximums for their cables. You should believe these recommendations when you see them.*

◆ *RS-232 Serial Printers—10-50 feet (15.25 meters). However, some references use 100 feet as the acceptable length of an RS-232C serial cable. Serial connections are tricky enough without problems generated by the cable being too long. Make the cable as short as possible.*

Infrared Printers

◆ *Many portable computer designs include an IrDA* _{Infrared data association} *-compliant port to provide wireless communications with devices such as character printers.*

◆ *The IrDA specification calls for communication ranges up to 2 meters (6feet), but most implementations state 1 meter as the recommended maximum range.*

◆ *All IrDA transfers are carried out in half-duplex mode and must have a clear line of sight between the transmitter and receiver.*

IrDA Printer
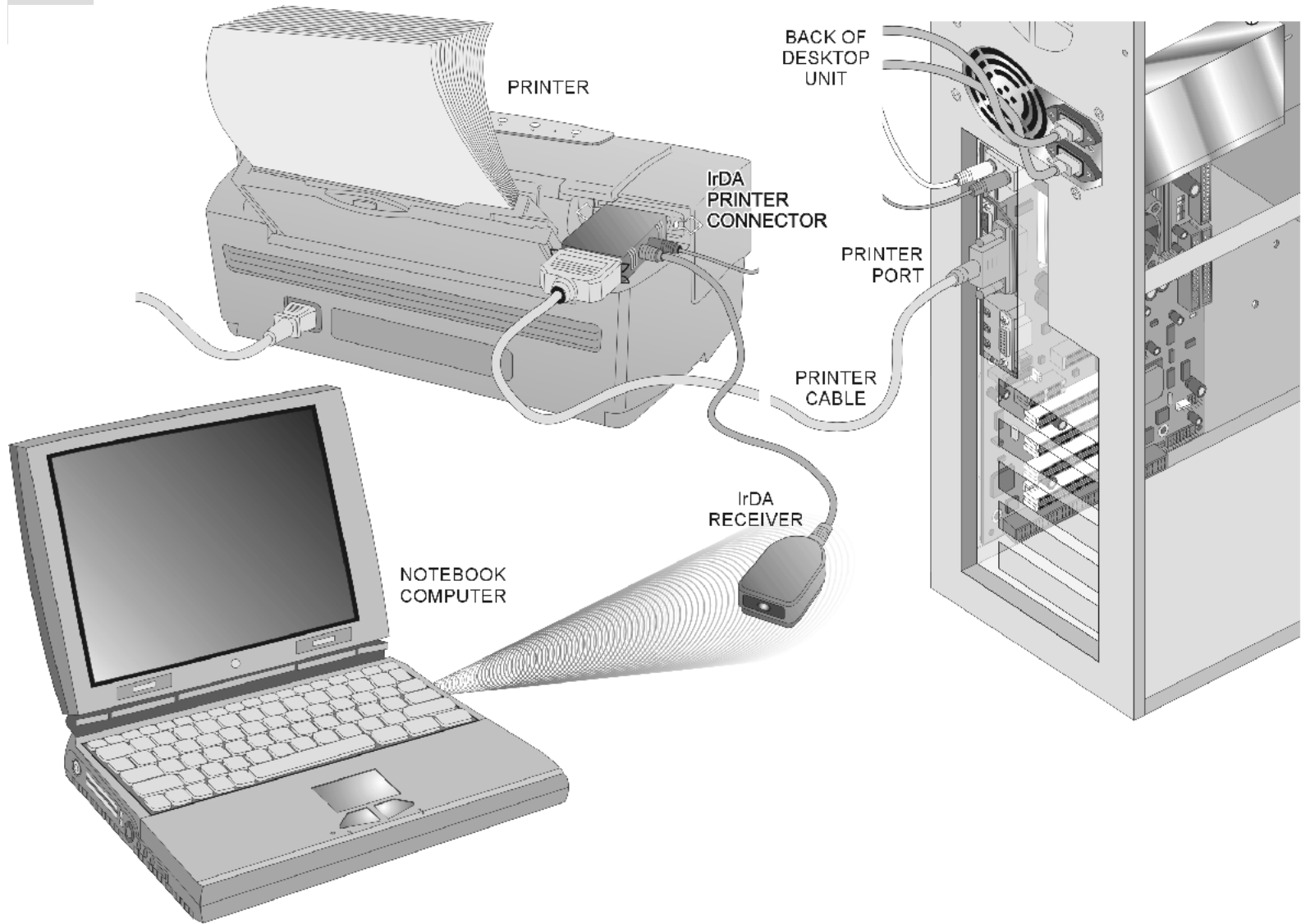
Networked Printers

◆ *It come with built-in network interfacing that enables them to be connected directly into the Local Area Network.*

◆ *Most network printers contain an integrated network controller and Ethernet LAN adapter that enable it to work on the LAN without a supporting host computer.*

The End