Introduction to
Laser Printer Service

Service Training

Version 1.0

Introduction to Laser Printer Service

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Introduction

Welcome!

Welcome to the Introduction to Laser Printer Service Course.

This is the first of two courses you must successfully complete to become an Apple-certified laser printer service technician. This course introduces you to Apple® laser printers and to the skills and knowledge you need to service them. Upon successful completion of this course, you are eligible to attend the Laser Printer Service Course lab.

The lab is a three-day course offered at an Apple training center. The course provides the skills, information, and hands-on activities for you to thoroughly learn about two of Apple's laser printer families. Upon successful completion of the Laser Printer Service Course, you are an Apple-certified laser printer service technician.

Note: If you are a support provider, such as an Apple Support Coordinator, Apple Technical Coordinator, or Apple Education Support Coordinator, and do not perform hardware repairs, you need only complete the Introduction to Laser Printer Service Course. Contact your regional Apple Service Training Registrar for more information.

Prerequisites

Before beginning this course, you should:

* Complete the Macintosh Service Course (also called Macintosh Service & Tools Course)
* Know how to measure voltage and resistance using a digital multimeter
* Know how to read wiring and schematic diagrams

Course Materials

The materials for this course include a participant manual and videotape. You are reading the participant manual now. The manual has four modules:

1. "Theory of Operation"
2. "Laser Printer Features"
3. "Set Up"
4. "Troubleshooting Basics"

The videotape illustrates key principles of the printing process. The "Theory of Operation" module directs you to view the videotape.

Introduction

Additional Materials and Equipment

In order to complete this course, you need to provide the following materials and equipment:

- HyperCard® application version 2.0 or later (required to complete the final test)
- Macintosh® computer (any model) with system software 6.0.7 or later
- Macintosh-compatible CD-ROM drive
- 3 Apple LaserWriters: one that connects via a SCSI interface, one that connects via LocalTalk, and one that has a serial interface
- *Apple Service Source* CD-ROM
- Videotape player and monitor
- All necessary cables and owner's manuals
- AppleLink® software and equipment

Module Outline

As you proceed through the four modules in this course, you will learn:

- How laser printers operate
- The basic features of Apple laser printers
- How to set up Apple laser printers
- The skills you need to troubleshoot Apple laser printers

Each module in this course includes a list of module objectives, module activities, and practice exercises. Objectives are tasks you should be able to perform at the end of the module. Read the list of objectives before beginning the module. If you feel you can meet all the module objectives, go directly to the practice exercises. The module activities include reading information in the participant manual, viewing the videotape, setting up laser printers, and answering questions about what you have learned.

Final Test

To ensure you have met the course objectives, the course has a final test that you download from AppleLink at the end of the course. The test questions are similar to those you complete in the practice exercises at the end of each module.

When you finish and pass the test, an AppleLink memo automatically appears in your AppleLink Out Basket. The final step is to send your test results to the Apple corporate test administrator. The test administrator is the only person who has access to your test results. When you successfully complete the final test, you have passed the Introduction to Laser Printer Service. Apple will mail you a permanent certificate of completion.

Completing This Course

To learn the most from this course, follow these steps:

1. Gather the necessary materials and equipment in the materials list.

2. Find a quiet location to work where you can complete the course without disruption.

3. Begin the first module—"Theory of Operation."

4. Read the module and complete all the module activities.

5. Repeat steps 3 and 4 for all remaining modules. The information in the second, third, and fourth modules builds on the previous module(s), so Apple recommends you complete the modules in order.

6. Review the course and take the final test.

When you have gathered the necessary materials and equipment and found a quiet place to work, you are ready to start. Go to the "Theory of Operation" module and begin. Good Luck!

Overview

This module presents a Macintosh-to-laser-printer system; provides an overview of page creation, data transfer, and print generation; and includes normal printer functions and common symptoms of faulty operation. A Macintosh-to-laser-printer system includes these major components:

- Macintosh computer (any model)
- Application software (such as a word-processing program)
- Apple Laser Printer (any model)
- Printer software (in the System Folder)
- Data transfer technology (between the Macintosh and laser printer—including all cards, cables, and connectors)

All Apple laser printers use the printing technology described in this module. When you understand how a Macintosh-to-laser-printer system functions and can identify common causes of faulty operation, you will have learned much of the functional information you need to troubleshoot and repair faulty systems.

Objectives

After completing this module, you should be able to:

1) Define basic page description language terms and functions, and indicate possible causes of faulty laser printer operation.

2) Identify the software used by each Apple laser printer family and indicate possible causes of faulty operation.

3) Identify the terms and functions of the Macintosh-to-laser-printer data transfer technologies and indicate possible causes of faulty operation.

4) Identify the eight laser printer ready states.

5) Identify the sequence and function of the major stages of the laser printer print cycle, and indicate possible causes of faulty operation at each stage.

6) Identify possible causes of faulty laser printer operation when you have a problem or symptom description.

Overview

Module Organization

This module has four sections with practice exercises after each section:

- "Overview" outlines this module and presents the components of a Macintosh-to-laser-printer system.

- "Page Creation and Conversion" presents a functional overview of the page description languages that Macintosh computers and Apple laser printers use to display and print text and graphic information, as well as the common symptoms and causes of faulty page creation and conversion.

- "Data Transfer Technology" introduces four types of data transfer technology that exchange information between the computer and the laser printer, as well as the common symptoms and causes of faulty data transfer.

- "Print Generation" presents the ready states, a functional description of the print cycle stages, and the common symptoms and causes of faulty operation at each stage.

Begin the next section—"Page Creation and Conversion"—on the following page.

Page Creation and Conversion
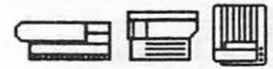
The printing process begins with the creation of a page (or pages) that contain text and/or graphic information. The information appears on the Macintosh screen and is stored in Macintosh RAM. When you print, the laser printer page description language converts the information, transfers it to printer RAM, and stores the data to be printed. This section begins by defining key page creation terms, followed by a description of the page description languages that convert and transfer the pages to the printer.

The following terms describe the page creation process:

QuickDraw performs all Macintosh graphic and text operations. QuickDraw is a set of routines (coded instructions that perform a series of operations) in Macintosh ROM. Applications access QuickDraw to create graphics and text that outputs to the computer screen or other devices, such as printers. Graphics and text appear on the screen as bitmap images.

Bitmapped images display on the computer screen as a collection of black dots and white spaces. Bitmapping refers to a method of storing information in computer memory. RAM stores bitmap fonts and graphics as dots and spaces in a corresponding location (or bit) in memory, as Figure 1-1 shows.

0	1	1	1	1	0
1	0	0	0	0	1
1	0	0	0	0	0
1	0	0	0	0	0
1	0	0	0	0	1
0	1	1	1	1	0

Computer Screen   Computer Memory
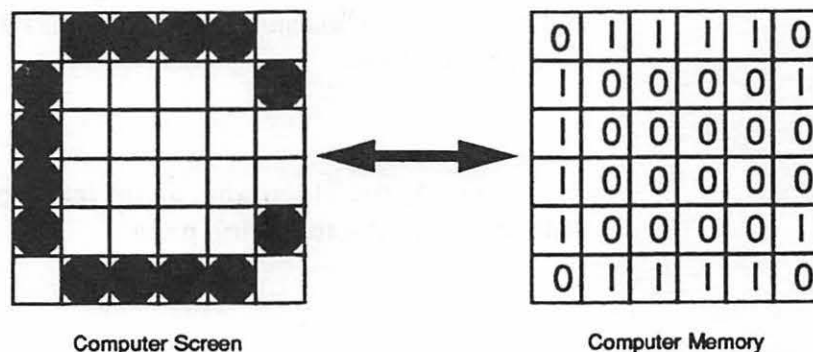
Figure 1-1
A bitmap of the letter 'C' on-screen and in computer memory
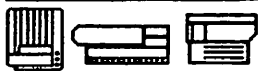
Page Creation and Conversion

Resolution describes the sharpness of an image in dots per inch (dpi). The Macintosh displays pixels (or dots) at approximately 72 dpi. The dots per inch correspond to a printer's point (1/72 inch) which is a standard of the printing industry.

The Macintosh computer screen has a relatively low resolution when compared to laser printers. Laser printers have a resolution of 300 to 600 dpi, depending on the printer. Phototypesetters print at even higher resolutions (1,000 dpi and higher). A page printed by a laser printer or phototypesetter appears much sharper than the image on the screen because it has a larger number of smaller dots.

The user selects **screen fonts** (bitmapped) that QuickDraw uses to display text on the computer screen. Fonts are a set of characters in one size and style. Font sizes are expressed in points, such as 12 points. Style refers to the shape and weight of a font. **Times bold** and *Times italic* are two styles of the Times font family. A font family is a complete set of characters for one font, including all styles and sizes.

Laser printer drivers are Macintosh system software files that interface the Macintosh with a laser printer.

View Part 1—The Print Controller—of the *Introduction to Laser Printer Service* videotape now. Part 1 illustrates font creation and transfer from the computer to the laser printer, and provides an excellent introduction to the QuickDraw and PostScript page description languages.

After viewing the videotape, begin reading about page description languages on the following page.

Page Creation and Conversion

QuickDraw performs all Macintosh graphic and text operations. Once information is created and stored in RAM, either the QuickDraw or PostScript page description language converts the information and transfers it to printer RAM. QuickDraw is for single-user non-network systems; PostScript is for single- and multiuser networks. This section of the module describes the QuickDraw and PostScript page description languages.

QuickDraw Page Description Language

The laser printer driver manages the page conversion process. Laser printers that use QuickDraw require a print driver with a non-networked LaserWriter icon followed by the name of the printer. Figure 1-2 shows the printer driver icon for the LaserWriter IISC.

LaserWriter IISC

Figure 1-2
The LaserWriter IIsc printer driver icon

QuickDraw laser printers require a Prep file in addition to the appropriate printer driver. The Prep file enhances performance by compressing the bitmaps. The prep file has:

1) the name of the printer that requires the prep file, and
2) the word *Prep* following the printer name

Figure 1-3 shows the Prep file for the Personal LaserWriter LS.

Personal LW LS Prep

Figure 1-3
The Personal LaserWriter LS Prep file icon
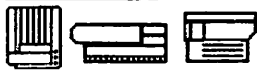
Page Creation and Conversion

The QuickDraw laser printer driver converts information from computer RAM into the 300 dpi resolution the printer requires. Graphic images are converted using QuickDraw routines. Text is converted using "4x" (four times) or TrueType fonts.

4x fonts are identical to and four times larger than screen fonts and must be installed in the System Folder for every screen font. 4x fonts are included on the laser printer *Fonts* disk. The 4x fonts translate the 72 dpi screen font to 300 dpi more efficiently than QuickDraw. For example, 72 (screen font dpi) times four equals 288, which is very close to the laser printer 300 dpi. If a 4x font is not installed, QuickDraw uses the less efficient process of scaling to create a 300 dpi image. QuickDraw scaling causes text to look jagged—a common customer complaint.

QuickDraw laser printers can also use the TrueType fonts on the laser printer *Fonts* disk. TrueType works on all models of Macintosh computers using system software version 6.0.7 or later. A single TrueType font allows you to create any size character, even odd sizes like 31-point, and the font will look smooth both on-screen and on paper. TrueType fonts permit a single font to be scaled to any size or style and eliminates the need for 4x fonts. When TrueType runs on QuickDraw laser printers, files still travel page-by-page to the printer, where the TrueType fonts convert to bitmaps.

PostScript Page Description Language

PostScript is one of the industry-standard page description languages that uses outline font technology to describe text, graphics, and digitized images for printed pages. Outline font technology defines each character as a combination of straight and curved lines that form the outline of a character. The characters are stored as mathematical formulas that specify the formation of font sizes and styles, and graphics. The Laser Prep file stores the definitions that interpret the mathematical formulas. The printer controller uses Laser Prep to process the formulas. After the size and style of each letter is defined, the controller fills in the outline with dots at the specific resolution of the print device. Figure 1-4 shows the difference between the QuickDraw bitmap 4x fonts and the PostScript outline font technology.
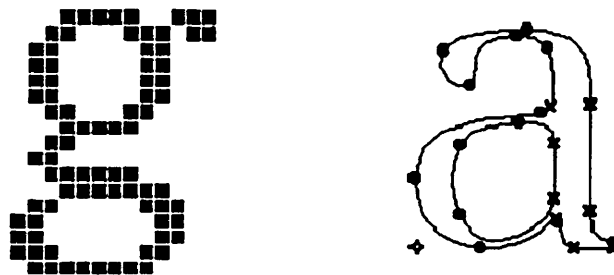
Figure 1-4
QuickDraw vs. PostScript fonts

Page Creation and Conversion

Again, the laser printer driver manages the page conversion process. PostScript laser printers require the printer driver called "LaserWriter," as Figure 1-5 shows.

LaserWriter

Figure 1-5
The PostScript laser printer driver icon version 6.1 and higher

The PostScript laser printer driver uses Laser Prep to convert the pages of text and graphic bitmap images in computer RAM to mathematical formulas. Laser printers using the LaserWriter print driver in Figure 1-5 incorporate the LaserPrep file for driver versions 6.1 and higher.

Laser Prep does not reside in printer drivers below version 6.1. Older versions of the PostScript printer driver require the installation of a separate Laser Prep file into the System Folder. Figure 1-6 shows the icon for older versions of the PostScript printer driver and the separate Laser Prep file icon.

LaserWriter   Laser Prep

Figure 1-6
The PostScript printer driver icon version 6.0 and lower, and Laser Prep file icon

QuickDraw uses fonts in the System Folder, whereas PostScript uses PostScript fonts in printer ROM and RAM. PostScript laser printers permanently store several PostScript font families in ROM. Fonts that are not from a resident font family must be loaded into printer RAM before you print a document.

Page Creation and Conversion

The process of copying nonresident fonts from a computer to printer RAM is called font downloading. Some applications automatically search computer RAM for the font and download it to laser printer RAM. When using applications that do not automatically download the fonts in a document, the user must use a font-downloading utility to manually download the font(s). If a needed font is not downloaded, the print controller creates a bitmap version of the font. Bitmap font creation slows the printing process and generates characters that are less well defined.

If a limited amount of printer RAM is available, the printer may download the font temporarily until the file prints, and then erase the font. If enough RAM is available, the printer may download the font until the printer is switched off or a user removes it using a font-downloading utility. If the laser printer has a SCSI port, you can attach up to six hard disks to permanently store downloaded fonts so that they are always available to the laser printer, just as if they were in printer RAM. The fonts are permanent until they are removed by the user, even if the printer is switched off.

When TrueType is used with Macintosh computers printing to PostScript printers, you need only one font installed in the System file for each family of fonts. TrueType fonts eliminate the need for a separate set of bitmapped fonts for each size and style of font. TrueType is primarily a screen font and does not replace the PostScript fonts, which are required by PostScript laser printers.

With TrueType fonts, PostScript converts a file to mathematical formulas before the file arrives at the printer. The printer uses PostScript fonts to re-create the page in printer RAM. If the file requires a PostScript font that is not available in printer RAM or for downloading but is an available TrueType font, PostScript can use the TrueType font to print the file.

Faulty Page Creation and Conversion

Improper installation of printer files and fonts usually results in the inability to print, poor print quality, and/or poor printer performance. You are likely hear these symptoms from many of your customers when they try to print to laser printers that have just been set up. The likely causes of each of these common symptoms are on the next page.

Page Creation and Conversion

Common Symptoms	Likely Causes
Can't print to printer	• Printer driver is not installed. • Wrong printer driver is installed. • Laser Prep file (PostScript) or Prep file (QuickDraw) is not installed (if required). • TrueType fonts are installed on a Macintosh with a lower version of system software than 6.0.7.
The print quality is poor.	*QuickDraw laser printers:* TrueType or matching 4x fonts are not installed. *PostScript laser printers:* PostScript fonts are not available to support screen fonts.
Poor printing performance	*QuickDraw laser printers:* • TrueType or matching 4x fonts are not installed. • Large files with minimum of printer RAM. *PostScript laser printers:* • PostScript fonts are not available to support screen fonts. • Large files with minimum of printer RAM.

This list emphasizes the need to install the correct combination of printer driver(s), Prep file (if required), and fonts to ensure high-quality output and efficient printer system operation.

Continue with Practice Exercise 1 on the following page.

Practice Exercise 1

Directions

Complete Practice Exercises 1, 2, and 3, and then check your answers against the answer pages that follow the three exercises.

Match the terms that describe the QuickDraw and PostScript print process by writing the letter of the definition on the line next to the term it defines.

Terms

1. ___ Resolution
2. ___ Screen Fonts
3. ___ Font
4. ___ Font Family
5. ___ Font Style
6. ___ Font Size
7. ___ Bitmapped Fonts
8. ___ Laser Printer Driver
9. ___ Laser Prep
10. ___ 4x Fonts
11. ___ QuickDraw
12. ___ PostScript
13. ___ Page Buffer

Definitions

A. Interface between the Macintosh and the printer
B. A complete set of characters for one font, including all styles and sizes
D. The sharpness of an image, in dots per inch (dpi)
E. Displays text on the computer screen
F. A set of characters in one size and style
G. Appears as a collection of black and white dots
H. Converts graphics and text into mathematical formulas instead of bitmaps
I. Expressed in points
J. Area of printer RAM that stores a bitmapped image of the page
K. The characteristics (other than size) that uniquely define the fonts of a single font family
L. Required to translate the 72 dpi screen font to the 300 dpi laser printer resolution
M. Stores the mathematical formulas PostScript uses

When you finish, continue with Practice Exercise 2 on the next page.

Practice Exercise 2

Directions

Decide if a statement describes the QuickDraw page description language, the PostScript page description language, or both. Indicate your answers by writing Q (QuickDraw), P (PostScript), or B (both) next to each statement.

1. ____ The printer driver sends a bitmapped image of the page to the printer.

2. ____ Stores a bitmapped image of the page in the page buffer before the page prints

3. ____ Uses screen fonts to display text on the computer screen

4. ____ The printer driver sends mathematical formulas to the printer.

5. ____ Translates 72 dpi screen fonts to 300 dpi using 4x fonts

6. ____ Transfers data to the printer using AppleTalk

7. ____ Uses QuickDraw routines to display text and graphics on the computer screen and to store text and graphics in computer RAM

8. ____ Uses a driver with a non-networked laser printer icon

9. ____ Uses Laser Prep, which resides within the laser printer driver if the driver is version 6.1 or later.

10. ____ The laser printer controller re-creates the page to be printed by reconverting the mathematical formulas that describe the page.

When you finish, continue with Practice Exercise 3 on the next page.

Practice Exercise 3

Directions

Read each customer printing problem and list the possible causes of faulty operation in the space after each statement.

1. You receive a call from a customer who states that his QuickDraw laser printer takes an exceptionally long time to print. What page-creation-and-conversion problems can cause slow printing?

2. A customer tells you that after setting up her new PostScript laser printer she cannot print. What page-creation-and-conversion problems can cause the printer not to print?

3. A customer complains that the print quality of his new PostScript laser printer is inferior to the printer demonstration he received in your store. What page-creation-and-conversion problems can cause poor print quality?

When you are ready, compare your answers to Practice Exercises 1-3 with those provided on the following three pages.

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Practice Exercise 1 (Answers)

Compare your answers to Practice Exercise 1 with the answers below.

1.   D   Resolution

2.   E   Screen Fonts

3.   F   Font

4.   B   Font Family

5.   K   Font Style

6.   I   Font Size

7.   G   Bitmapped Fonts

8.   A   Laser Printer Driver

9.   M   Laser Prep

10.   L   4x Fonts

11.   C   QuickDraw

12.   H   PostScript

13.   J   Page Buffer

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.
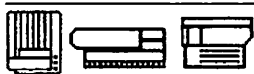
Practice Exercise 2 (Answers)

Compare your answers to Practice Exercise 2 with the answers below. Use the following key: Q (QuickDraw), P (PostScript), or B (both).

1. _Q_ The printer driver sends a bitmapped image of the page to the printer.

2. _B_ Stores a bitmapped image of the page in the page buffer before the page prints

3. _B_ Uses screen fonts to display text on the computer screen

4. _P_ The printer driver sends mathematical formulas to the printer.

5. _Q_ Translates 72 dpi screen fonts to 300 dpi using 4x fonts

6. _P_ Transfers data to the printer using AppleTalk

7. _B_ Uses QuickDraw routines to display text and graphics on the computer screen and to store text and graphics in computer RAM

8. _Q_ Uses a driver with a non-networked laser printer icon

9. _P_ Uses Laser Prep, which resides within the laser printer driver if the driver is version 6.1 or later.

10. _P_ The laser printer controller re-creates the page to be printed by reconverting the mathematical formulas that describe the page.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

Practice Exercise 3 (Answers)

Compare your answers to Practice Exercise 3 with the answers below.

1. You receive a call from a customer who states that his QuickDraw laser printer takes an exceptionally long time to print. What page-creation-and-conversion problems can cause slow printing?

    TrueType or matching 4x fonts are not installed. The customer could also be printing large files with a minimum amount of printer RAM.

2. A customer tells you that after setting up her new PostScript laser printer she cannot print. What page-creation-and-conversion problems can cause the printer not to print?

    The printer driver and/or Laser Prep file (if driver version is below 6.1) is incorrect. TrueType fonts are installed on a Macintosh computer with a driver version earlier than 6.0.7.

3. A customer complains that the print quality of his new PostScript laser printer is inferior to the printer demonstration he received in your store. What page-creation-and-conversion problems can cause poor print quality?

    PostScript fonts are not available to support the screen fonts for the document being printed. Large files are printing with a minimum amount of printer RAM.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

These exercises help you use the theory of operation to identify a problem area. You are not expected to identify the exact causes of common symptoms. The "Troubleshooting" module presents resources that will help you isolate all possible causes of faulty operation.

When you are ready, continue with the next section of the module— "Data Transfer Technology."
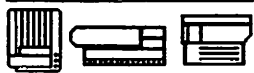
Data Transfer Technology

This section introduces the types of data transfer technology that Macintosh computers and laser printers use to communicate with each other, and identifies common symptoms and causes of faulty data transfer.

The Macintosh computer and Apple laser printer use three types of data transfer technology to communicate, including serial, SCSI, and AppleTalk technology. Serial and SCSI technologies are for single-user system configurations using QuickDraw (non-networked) laser printers. AppleTalk technology is for single- and multiuser network system configurations.

Serial and SCSI Technology

Laser printers using the QuickDraw page description language transfer data between the computer and a printer that use serial and/or SCSI technology. As you will recall from the previous section, QuickDraw converts the pages in computer RAM into 300 dpi bitmap pages. The data then transfers page by page to the print controller on the printer I/O PCB, where the 300 dpi bitmap pages re-create. The re-created pages are stored in the page buffer until they print. Like the page conversion process, the QuickDraw printer driver manages the data transfer process.

Serial technology is the slowest of the three laser printer data transfer technologies. A serial interface sends one bit of data at a time on one line from the computer to the printer. To enhance the transfer rate, the printer driver for serial laser printers uses a Prep file to compress the data before it transfers. The laser printer decompresses the data before storing it in printer memory.

SCSI (Small Computer System Interface) technology is faster than serial technology. SCSI technology provides a parallel interface that moves 8 bits of data at a time, 1 bit on each of eight lines. As with all SCSI devices, laser printers that use SCSI technology must have unique identification numbers and proper termination.

Data Transfer Technology

Faulty Serial and SCSI Operation

Two common symptoms indicate faulty serial or SCSI technology. The symptoms and likely causes are:

Common Symptoms

Computer can't find the laser printer and/or can't print to the printer.

Likely Causes

One or more of the following conditions exists:

- The correct driver (and Prep file, if required) is not installed.
- The correct driver is not selected.
- The printer is off.
- The printer is not correctly connected to the computer (cables fastened and connected to correct port, etc.).
- The SCSI identification number is not unique.

AppleTalk Technology

Laser printers with the PostScript page description language use AppleTalk technology to transfer data between the computer and the printer. As you will recall from the previous section, PostScript converts the pages in computer RAM into mathematical formulas using Laser Prep. Once converted, the formulas transfer to the print controller on the printer I/O PCB and reconvert into bitmap pages. The bitmap pages are stored in the page buffer until they print. Like the page conversion process, the PostScript printer driver manages the data transfer process.

Network communication protocols are the rules that control interaction between devices on a network. AppleTalk is the name of Apple's network communication protocols. Protocols determine how devices on a network transfer data on the same cable in an orderly manner. An AppleTalk network is a collection of devices that exchange information using AppleTalk over some medium. Two of the most common media for AppleTalk networks and Apple laser printers are LocalTalk and EtherTalk.

LocalTalk is an inexpensive AppleTalk medium for moderate data transfer rates. LocalTalk consists of cables, connectors, and cable extenders. The LocalTalk shielded twisted-pair cable from Apple supports a maximum of 32 devices and can span up to 1000 feet. LocalTalk requires each device to have a connector and to be daisy-chained to other devices with connector cables. With some printers, a single Peripheral-8 cable can be used to communicate between a single computer and a laser printer. Refer to the appropriate owner's guide for more information about LocalTalk cabling requirements.
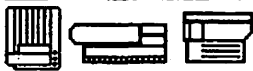
Data Transfer Technology

Apple's EtherTalk medium permits AppleTalk protocols to run on high-speed Ethernet coaxial cable and has the fastest data transfer rate of the technologies in this module. Apple's Ethernet Think Coax supports up to 40 active nodes and a total cable length of 200 meters. An EtherTalk network is often part of an internet (two or more networks connected together) that includes one or more LocalTalk networks and can potentially include millions of users. To use the EtherTalk medium, some Macintosh computers require the installation of an EtherTalk card.

Networks can have different sizes, shapes, and types of devices. One function of communication protocols is to define network device addresses. By assigning a unique address to each device, users can transfer data between devices. The AppleTalk communication protocols refer to this addressing process as "naming." Each device on the network receives a unique name that the network recognizes as the device address. When you open the Chooser and select the laser printer icon, a list of all the names of the laser printers on the network appears. To print to a specific laser printer, you simply select the name of that laser printer. The AppleTalk protocols translate the name into the laser printer network address.

The LaserWriter utility on the laser printer *Utilities* disk allows you to name each laser printer on a network. If a printer is not named, the network uses a default naming scheme. The model name (for example, LaserWriter II) of the first laser printer on the network that is switched on is assigned to the printer. The same printer models are then assigned a number, beginning with 1 (for example, 1 LaserWriter II, 2 LaserWriter II, etc.) in the order in which each one was switched on.

In order for the network to "see" a laser printer and list printer names in the Chooser, the following conditions must exist:

1. The correct laser printer driver must be installed in the System Folder. All users on the network must use the same laser printer driver version.
2. The printer driver icon must be highlighted in the Chooser.
3. AppleTalk must be active. Even if the correct driver is installed and selected, the printer name will not appear in the Chooser unless AppleTalk is active.
4. The correct zone must be selected if the network is divided into zones.
5. The correct cables must be connected from a computer and laser printer to the network.
6. The laser printer must be switched on. The laser printer name will not appear in the Chooser until after the self-test executes and the User Test Page prints. The laser printer utilities (version 6.0.7 and higher) allows users to disable the User Test Page. The laser printer name will then appear in the Chooser after the self-test finishes.

Data Transfer Technology

Faulty AppleTalk Operation

The two common symptoms of faulty AppleTalk communication and their likely causes are:

<u>Common Symptoms</u>

Laser printer name not listed in the Chooser or the user can't print to the printer.

<u>Likely Causes</u>

One or more of the following conditions exists:

- The correct laser printer driver (and Prep file, if required) is not installed.
- The driver icon is not highlighted.
- AppleTalk is not active.
- The correct zone is not selected (if the network is divided into zones).
- The user's computer and the laser printer are not correctly connected to the network.
- The laser printer is off.

If none of the above conditions exists and the laser printer name still does not appear in the Chooser, the problem is most likely a user's computer, a user's computer system software, or the network software (if the user is on a multiuser network).

Practice Exercise 4

Directions

Complete Practice Exercises 4 and 5, and then check your answers against the answer pages that follow the exercises.

The following list contains statements about Macintosh-to-laser-printer data transfer technology. Use the key to indicate whether a term or statement relates to Serial, SCSI, LocalTalk, or EtherTalk technology. Try to respond to each item from memory.

S = Serial   E = EtherTalk
SC = SCSI   LE = LocalTalk and EtherTalk
L = LocalTalk

___ 1. Compresses data before it transfers to the printer

___ 2. Fastest data transfer rate of the four data transfer technologies

___ 3. An inexpensive AppleTalk medium with moderate data transfer rates

___ 4. A non-network technology that requires the installation of a prep file

___ 5. Transfers data on high-speed coaxial cable

___ 6. The user must assign a unique ID number to each laser printer

___ 7. May require the installation of a card in the Macintosh computer

___ 8. Using Apple equipment, supports a maximum of 32 devices and can span up to 1000 feet

___ 9. Requires that each laser printer have a unique name

___ 10. Supports up to 40 active nodes with a single cable length of 200 meters, and can potentially support millions of users with an internet network

When you are ready, continue with Practice Exercise 5 on the next page.

Directions

In the space provided, indicate the likely causes of each customer data transfer problem.

1. A customer states that his laser printer with a serial interface will not print. He indicates he installed and selected the correct driver. What data transfer problems can cause the inability to print?

2. You are helping a customer determine why the name of a new laser printer just added to the LocalTalk network does not appear in the Chooser. She indicates that the correct driver (a separate Laser Prep file is not required) is installed and selected in the Chooser, and that the printer has a name. What data transfer problems can cause this problem?

3. While talking to a customer, you find that he cannot print to his new laser printer with a SCSI interface. He states that the correct driver is installed and selected, that the SCSI cable is correctly connected to the computer and the printer, and that the printer is switched on. What is the likely faulty-data-transfer cause of this problem?

When you are ready, compare your answers to Practice Exercises 4 and 5 with the answers on the next two pages.

Practice Exercise 4 (Answers)

Compare your answers to Practice Exercise 4 with the answers below. Use the following key: S (Serial), SC (SCSI), L (LocalTalk), E (EtherTalk), LE (LocalTalk and EtherTalk).

S   1. Compresses data before it transfers to the printer

E   2. Fastest data transfer rate of the four data transfer technologies

L   3. An inexpensive AppleTalk medium with moderate data transfer rates

S   4. A non-network technology that requires the installation of a Prep File

E   5. Transfers data on high-speed coaxial cable

SC   6. The user must assign a unique ID number to each laser printer

E   7. May require the installation of a card in the Macintosh computer

L   8. Using Apple equipment, supports a maximum of 32 devices and can span up to 1000 feet

LE   9. Requires that each laser printer have a unique name

E   10. Supports up to 40 active nodes with a single cable length of 200 meters, and can potentially support millions of users with an internet network

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

Practice Exercise 5 (Answers)

Compare your answers to practice Exercise 5 with the answers below.

1. A customer states his laser printer with a serial interface will not print. He indicates he installed and selected the correct driver. What data transfer problems can cause the inability to print?

   The Prep file (required by serial printers) may not be installed. The printer may not be switched on or correctly connected to the Macintosh. A unique SCSI ID number may not be assigned.

2. You are helping a customer determine why the name of a new laser printer just added to the LocalTalk network does not appear in the Chooser. She indicates that the correct driver (a separate Laser Prep file is not required) is installed and selected in the Chooser, and that the printer has a name. What data transfer problems can cause this problem?

   The correct zone (if the customer's network has zones) may not be selected. The customer's Macintosh and/or the new laser printer may not be connected correctly, AppleTalk is not active, and/or the printer may not be switched on.

3. While talking to a customer, you find that he cannot print to his new laser printer with a SCSI interface. He states that the correct driver is installed and selected, that the SCSI cable is correctly connected to the computer and the printer, and that the printer is switched on. What is the likely faulty-data-transfer cause of this problem?

   The SCSI ID is not unique.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

When you are ready, continue with the next section of the module— "Print Generation."

Print Generation

This section presents the print generation cycle of the printing process—specifically, how a laser printer generates a printed page and the functions of the I/O PCB and print engine.

I/O PCB Overview

The I/O PCB provides the interface between the computer or network and the laser printer. The QuickDraw Laser Printer I/O PCB communicates with the Macintosh via the SCSI connector or the serial port. The PostScript laser printer I/O PCB communicates with a network using AppleTalk protocols over LocalTalk or EtherTalk media.

Both types of I/O PCBs contain cable connectors, a SCSI ID number selector (when configured with a SCSI interface), ROM, RAM, and a microprocessor. Some PostScript laser printer I/O PCBs also have a SCSI connector for connecting a hard disk to the printer for additional font storage. The features of specific I/O PCBs are covered later in the course.

Print Engine Overview

The print engine has four systems—the power distribution system, the control system, the image/formation system, and the pickup/feed system. The four print engine systems interact during each stage of the print cycle. Figure 1-7 on the next page shows the relationship of the four laser printer systems.

The **Power Distribution System** receives power through the AC power cord receptacle and provides power to the other three systems. Power flows directly to some systems, while others receive power indirectly through the DC Controller PCB. The Power Distribution System provides AC and DC current, as well as high voltage.

The **Control System** manages the print engine. The DC Controller PCB—which monitors all functions of the laser printer—receives a command to print from the I/O PCB and issues control signals to the modules and parts in all other systems during the print cycle. The Control System communicates print engine status to the user via the display panel LEDs on the front of the laser printer. Always remember to check the DC Controller PCB as part of your troubleshooting procedures because it controls the entire engine. A module may seem faulty but in reality may not have received the command or voltage it needs.

The **Image Formation System** uses a laser beam to transfer bitmap images waiting to print in the page buffer, bit by bit, to a photosensitive drum. Charged particles or toner jumps to the image on the drum and transfers to the page as the drum moves. After passing the photosensitive drum, the printed page moves through the Fuser Assembly where the toner melts onto the paper.

The **Pickup/Feed System**, or Paper Pickup/Feed System, moves sheets of paper through the print engine. Starting at the paper cassette, each sheet lifts, aligns, and moves past the Photosensitive Drum, where the image transfers to the paper. Finally, the Pickup/Feed System delivers the printed page to the paper delivery tray.
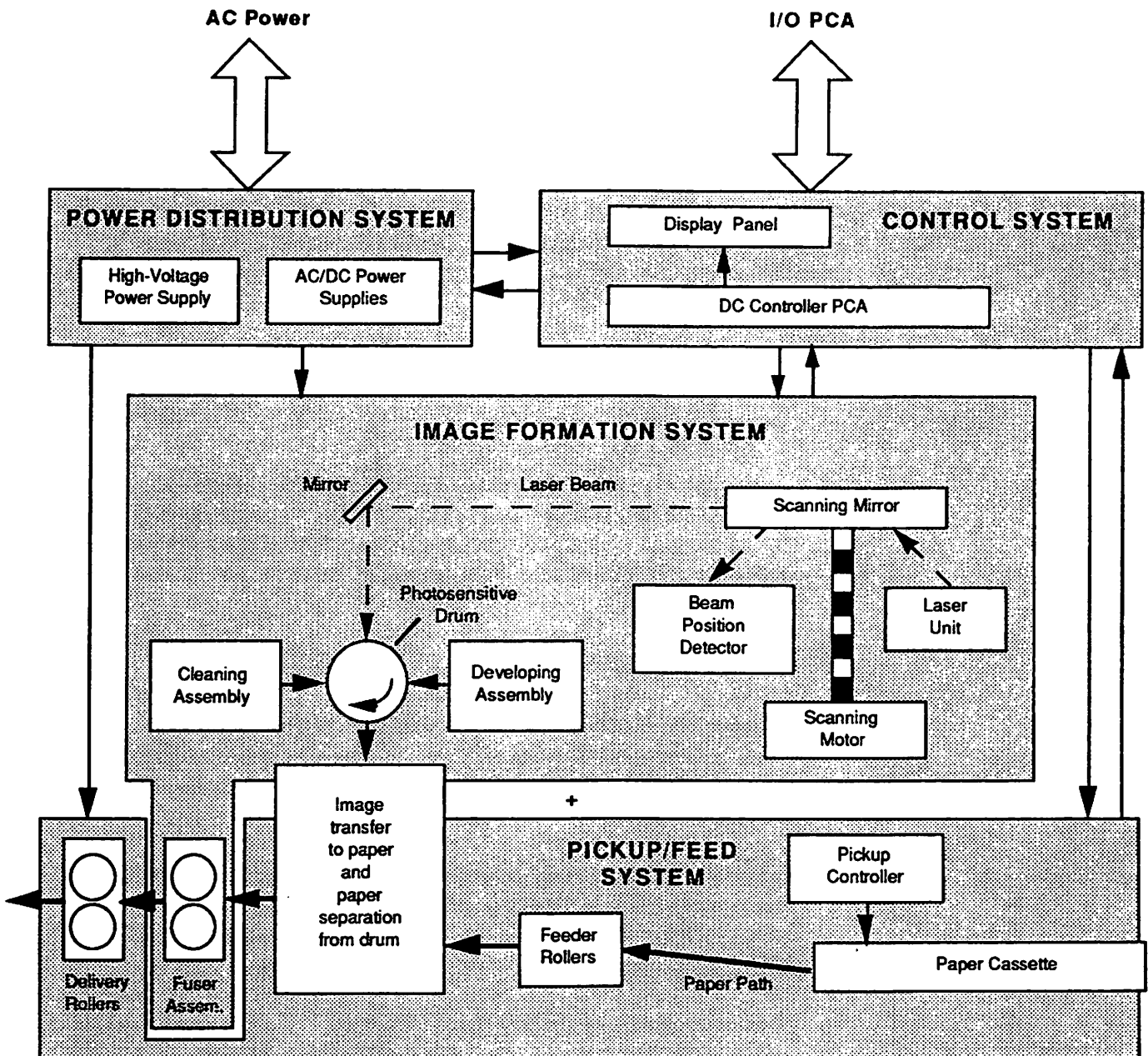
Print Generation

Figure 1-7
The four laser printer systems

Print Generation

Ready States

Ready states are the conditions that must exist before a print cycle initiates. A ready state means the laser printer can begin a print cycle. There are nine key ready states, some of which do not apply to all laser printers. Knowing the ready states will help you more quickly and accurately isolate the cause of a faulty laser printer.

One of the DC Controller sensors constantly monitors each ready state. When the sensor confirms the existence of all nine ready states, it initiates a print cycle after receiving a command from the I/O PCB. When troubleshooting, try to determine whether the DC Controller or the sensor is faulty before you isolate the problem to a module or part.

The nine ready states are:

1. *Access door closed.*

2. *Correct paper cassette and paper installed*—A sensor determines if the paper cassette is installed. Another sensor determines if the paper cassette is the correct size for the page setup parameters set by the user. A third sensor determines if the paper cassette contains paper. If the sensors are faulty, the printer cannot come to a ready state.

3. *Toner cartridge installed.*

4. *No paper jam*—Paper jams occur when: 1) a sheet of paper sticks in the paper path when the laser printer is switched on, and 2) a sheet of paper does not reach or clear the delivery sensor (the final sensor before the page exists the printer) within the required time.

5. *Main motor rotates properly (LaserWriter and LaserWriter Plus only)*—The main motor rotates briefly and the fuser rollers (part of the Fuser Assembly) turn after power-up. Listen for the high-pitched whine of the main motor and watch for the turning fuser rollers immediately after switching on the laser printer.

6. *Scanning motor scans at proper speed*—The scanning motor turns the scanning mirror, which rotates at a very precise speed. The mirror reflects the laser scan beam from the Laser Assembly onto the photosensitive drum inside the toner cartridge. If the scanning motor does not turn the mirror at the correct speed, an accurate image will not scan onto the photosensitive drum. You can determine if the scanning motor is functioning by listening for a high-pitched whine (higher pitched than the main motor) during a print cycle. If the ready light is on but the print cycle immediately stops, the problem may be the scanning motor.

Print Generation

7. *Laser beam temperature is normal* —The laser beam produces images on the photosensitive drum. The DC Controller checks the laser beam temperature before a print cycle initiates. To verify proper operating temperature, refer to *Apple Service Source* and the wiring diagram for laser voltage levels.

8. *Fuser roller temperature is acceptable*—The fuser assembly fuses the toner image onto the paper and houses two pressure rollers. The fuser roller contains a heater bulb that heats the toner and paper. A cool fuser roller will not fuse the toner. If the roller is too hot, the paper and roller can be damaged or the paper may move to the delivery tray without an image.

   You can determine if the fuser heater bulb lights by looking through the door or tray openings near the Fuser Assembly when you switch on the printer or during the print cycle. If the bulb lights, you know it has power and has not burned out.

9. *Fan rotates (Personal LaserWriter only)*—The fan must rotate on all Personal LaserWriter models. If the fan wire breaks or an object stops the fan from turning, the printer will not come to a ready state.

Review the ready states until you can recall them from memory.

Continue with Practice Exercise 6 on the next page.
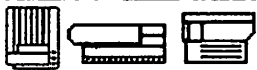
Practice Exercise 6

Directions

Place an X in front of each ready state. Cover the answers on the facing page to complete this exercise.

___ Laser Prep files are properly installed in printer RAM (LaserWriter II).

___ Registration assembly solenoid functions.

___ Fuser roller temperature is acceptable.

___ Access door is closed.

___ Toner cartridge is at least 10 percent full of toner.

___ Toner cartridge is installed.

___ Paper cassette has at least three sheets of paper.

___ Printer does not sense a paper jam.

___ Fan functions (Personal LaserWriter).

___ User Test Page prints (LaserWriter II).

___ Cassette and paper are installed.

___ Main motor rotates properly (LaserWriter and LaserWriter Plus).

___ Pickup roller rotates at correct intervals.

___ Scanning motor scans at the proper speed.

___ Laser beam temperature is normal.

When you finish, compare your answers with those on the next page.

Practice Exercise 6 (Answers)

Compare your answers to Practice Exercise 6 with the answers below.

___ Laser Prep files are properly installed in printer RAM (LaserWriter II).

___ Registration assembly solenoid functions.

__X__ Fuser roller temperature is acceptable.

__X__ Access door is closed.

___ Toner cartridge is at least 10 percent full of toner.

__X__ Toner cartridge is installed.

___ Paper cassette has at least three sheets of paper.

__X__ Printer does not sense a paper jam.

__X__ Fan functions (Personal LaserWriter).

___ User Test Page prints (LaserWriter II).

__X__ Cassette and paper are installed.

__X__ Main motor rotates properly (LaserWriter and LaserWriter Plus).

___ Pickup roller rotates at correct intervals.

__X__ Scanning motor scans at the proper speed.

__X__ Laser beam temperature is normal.

If you missed any items, review the appropriate section of the module and correct any incorrect answers.

When you are ready, continue with the next part—"Print Generation."
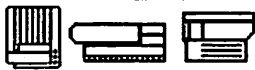
Print Generation

Print Cycle

View Part 2, Xerographic Imaging, of the *Introduction to Laser Printers Service* videotape. Part 2 presents an overview of the print cycle. The steps of the print cycle are very similar for all Apple laser printers, although some differences exist—such as the number of lenses, mirrors, or gears. The video illustrates the LaserWriter II print cycle.

The print cycle has six steps, as Figure 1-8 illustrates: drum charging, image formation, development, transfer, fusing, and drum cleaning.
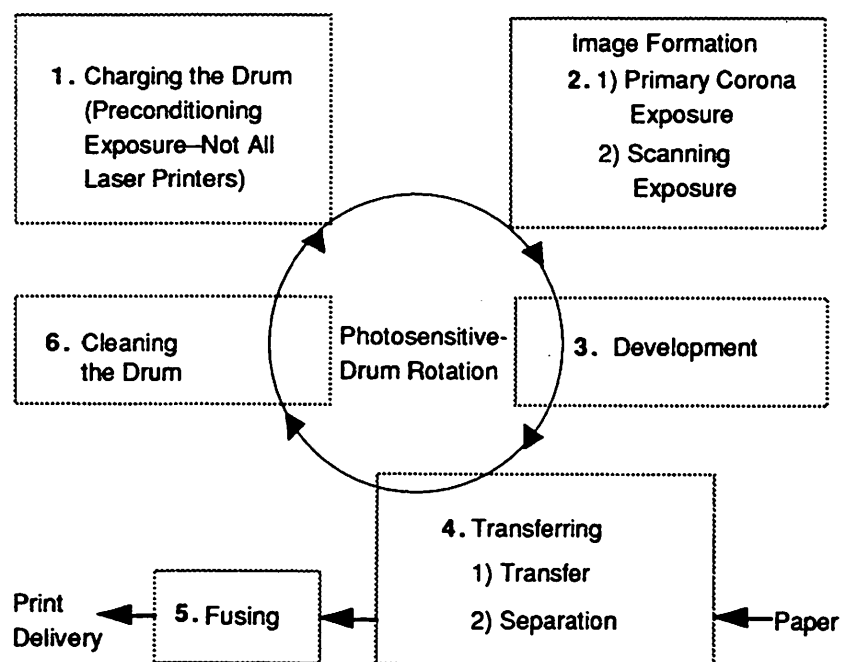
Figure 1-8
The laser printer print cycle

Drum Charging

The first step exposes the photosensitive drum—located in the toner cartridge—to light so the drum is ready to receive charges during Step 2. The light passes though the preconditioning exposure shutter on the toner cartridge. Note: some laser printers do not require this step. Refer to Figure 1-9 on the next page for the location of the drum and toner cartridge.

Image Formation

The second step produces a pattern of electrical charges on the photosensitive drum that is identical to the print image. Image formation has several stages. First, the photosensitive drum passes under the primary corona wire (see Figure 1-9 on the next page), which applies a uniform layer of negative charges over the drum surface.

Print Generation
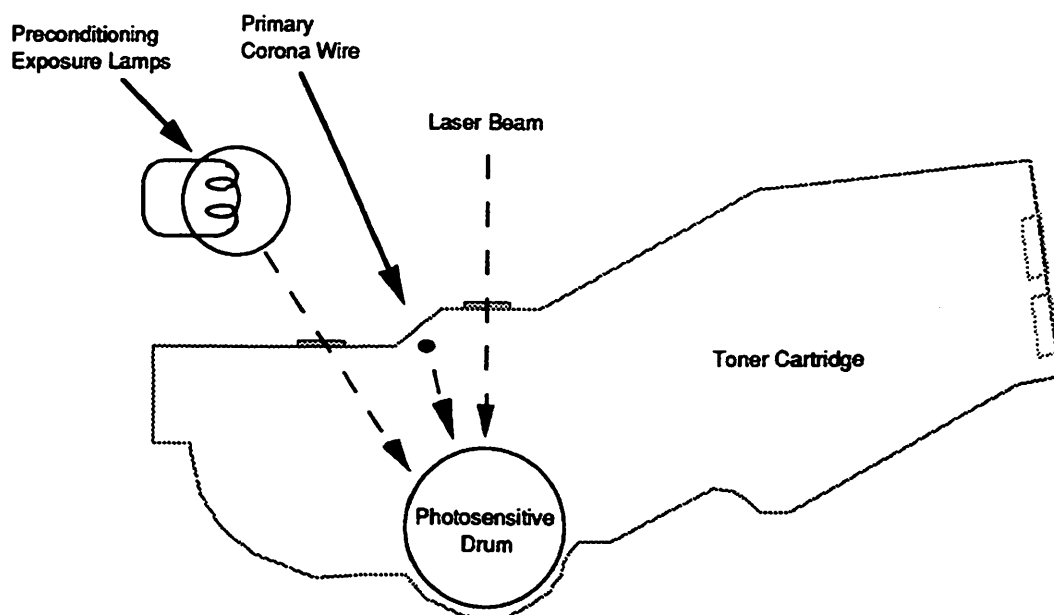
Figure 1-9
The LaserWriter II toner cartridge and photosensitive drum

Next, the DC Controller receives a print command from the I/O PCB and sends a command to the Laser/Scanner Assembly. The Laser/Scanner Assembly consists of the Laser Unit, scanning mirror, scanning motor, and focusing lenses. Refer to Figure 1-10 on the next page for an illustration of the laser scanning process.

The Laser/Scanner Assembly generates the laser beam that hits the photosensitive drum. The modulated laser beam first passes through a focusing lens and strikes a multifaced scanning mirror on the scanning motor, which rotates at a constant speed. The beam passes through additional lenses that reflect the beam onto the photosensitive drum. The laser beam exposes the drum surface, neutralizes the charges, and creates an invisible pattern.

Print Generation
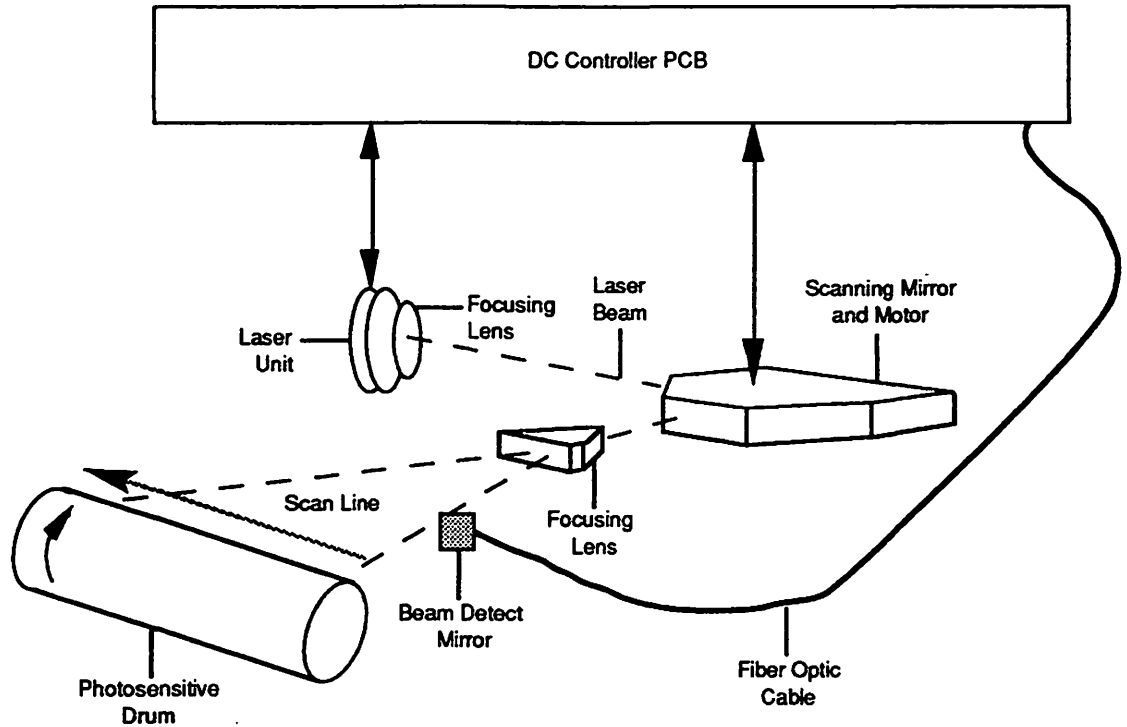
Figure 1-10
The laser printer laser scanning process and parts

During image formation, the photosensitive drum rotates at a constant speed that matches the speed of the beam. In the time it takes for the beam to return to its original position, the drum surface shifts down enough to accept the next scan line. When the beam reaches a new line, the beam detect mirror (see Figure 1-10) sends a light beam signal over the fiber-optic cable. This signal alerts the DC controller that the beam is at the home position. Another modulated beam then scans the drum. As each successive beam scans the drum, an image accumulates on the drum in the form of tiny dots that match the bitmapped image in the page buffer.

Print Generation

Charging and Image Formation: Faulty Operation

The charging and image formation steps of the print cycle have several common symptoms of faulty operation. The symptoms and likely cause(s) are:

Common Symptoms	Likely Cause(s)
Printer does not print.	Inoperable laser unit and/or scanner motor. These parts must function to specification for the printer to come to a ready state and initiate a print cycle.
A page has parts of the previously printed page, or appears gray or cloudy.	Check to see that the preconditioning exposure lamps function properly. If the lamps are inoperable, the photosensitive drum does not erase completely between print cycles.
The image does not appear on the photosensitive drum after the print cycle executes. (You can verify that an image does not appear on the drum by opening the printer in the middle of a print cycle. Then open the drum shutter on the toner cartridge and look for an image.)	Any one of the following conditions can cause this symptom: • The fiber-optic cable from the Laser/Scanner Assembly to the DC Controller is damaged. • The DC Controller malfunctioned and did not send the required commands to the Laser/Scanner Assembly. • The toner cartridge is damaged, or the cartridge flange that opens the laser shutter is broken. • The Laser/Scanner Assembly is damaged.
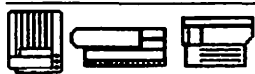
Print Generation

Development

In the third step—Development—the image on the photosensitive-drum surface develops into a visible image of toner particles. This process starts inside the toner cartridge with the developing cylinder (see Figure 1-11) that contains negatively charged toner powder. The toner particles jump from the cylinder to the exposed areas on the photosensitive drum that have a high positive potential. The difference in potential between the development cylinder and photosensitive drum is controlled by the print density adjustment dial, which allows you to create lighter or darker images.
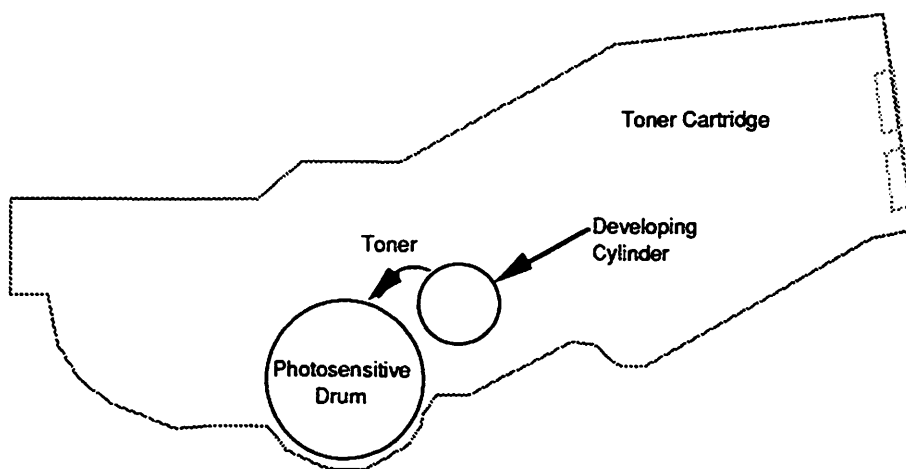
Figure 1-11
The LaserWriter II toner cartridge and developing cylinder

Development: Faulty Operation

The one common symptom of faulty operation at the development step of the print cycle and its likely causes are:

Common Symptom	Likely Cause(s)
The image is created in Step 2—Charging and Image Formation (refer to Figure 1-8) —but is not developed. (To verify that an image did not develop, open the printer in the middleof a print cycle. Open the drum shutter and check for an undeveloped image on the drum.)	One or more of the following conditions exist: • The toner cartridge is faulty or the toner tape needs to be removed. • The high-voltage power supply is faulty. • The DC Controller PCB malfunctioned and did not signal the high-voltage power supply to provide the correct voltage to the toner cartridge.

Print Generation
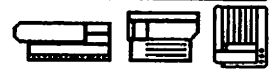
Transfer

During this fourth step of the laser printer print cycle (refer to Figure 1-8), the toner image on the drum surface transfers onto the paper in two stages. The paper passes between the photosensitive drum and the transfer corona wire assembly (or transfer roller on some laser printers), where the back of the paper receives a positive charge. The charge attracts the negatively charged toner particles to the paper, as Figure 1-12 illustrates
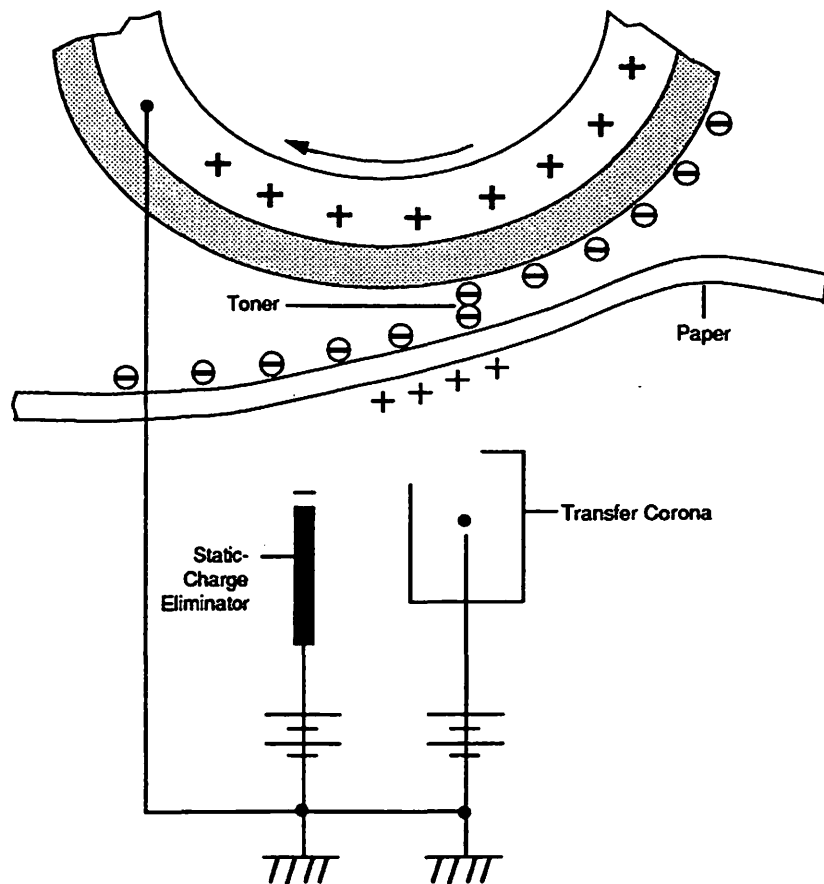
Figure 1-12
The transfer corona applies positive charges to the paper which attracts toner to the paper

Next, the stiffness of the paper and the negative voltage produced by a static-charge eliminator causes the paper to separate from the drum. By weakening the attractive force between the paper and the drum, the eliminator prevents thin paper from wrapping around the drum.

Print Generation

Transfer: Faulty Operation

The one common symptom of faulty operation at the transfer step of the print cycle and its likely causes are:

Common Symptom
The image developed in Step 3—
Development (refer to Figure 1-8)—
does not transfer to the paper.

Likely Cause(s)
One or more of the following conditions exists:

- The corona wire (or transfer roller on some laser printers) is damaged.
- The DC controller PCB did not provide the signal to the high-voltage power supply, which provides the voltage to the corona wire.
- The high-voltage power supply failed.

Fusing

The fifth step—Fusing—permanently fuses the image to the paper. After transfer, the toner remains on the paper only because of electrostatic attraction and a slight physical adhesion. A light touch smears the image.

The Fuser Assembly contains two rollers: the fusing roller and lower roller shown in Figure 1-13. The fusing roller contains a heater bulb that heats the toner and paper. The heat and pressure from both rollers fuses the toner particles onto the paper, creating a permanent image. The nonstick resin on the fusing roller keeps the paper from sticking to the roller and prevents offsetting (adhesion of toner from a page to the roller and subsequent transfer of that toner to another page).
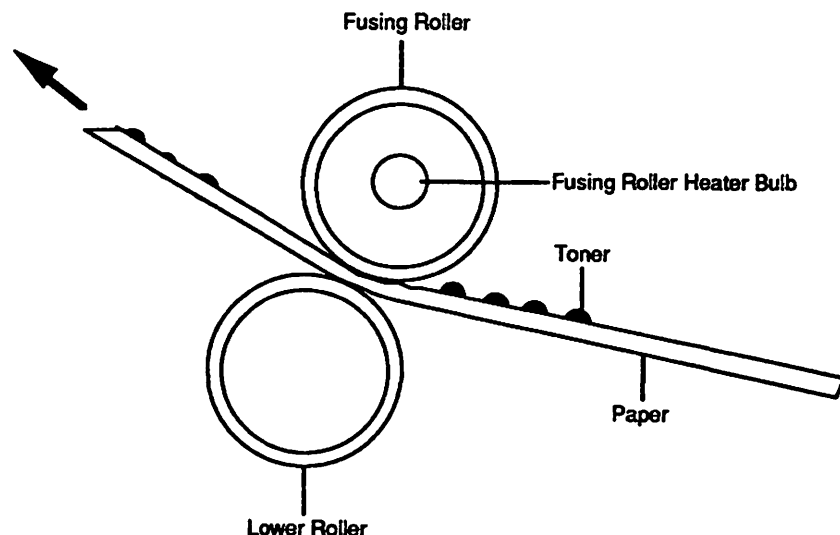
Figure 1-13
The Fuser Assembly

Print Generation
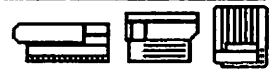
Fusing: Faulty Operation

The one common symptom of faulty operation at the fusing step of the print cycle and its likely cause is:

<u>Common Symptom</u>

The image transfers in step 4, Transfer (refer to Figure 1-8), but fails to fuse to the paper.

<u>Likely Cause</u>

If the upper or lower fuser rollers are worn, the proper amount of pressure to bond the toner to the paper is not applied. For the printer to come to a ready state, an operating fuser bulb is required.

Cleaning the Drum

During this last step of the print cycle, the drum is cleaned. Residual toner from the image is cleaned off the drum by the cleaning blade so that new images are clear and distinct. Figure 1-14 shows the location of the cleaning blade.
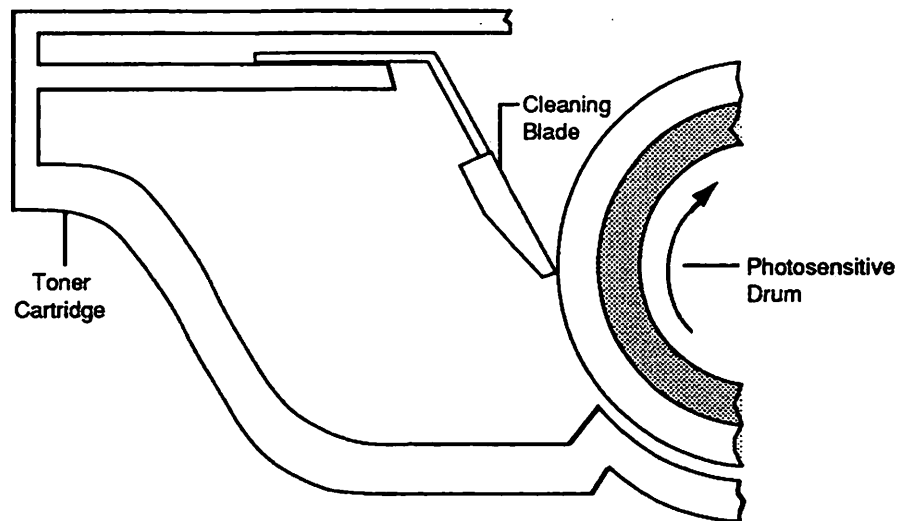
Figure 1-14
The toner cartridge drum-cleaning blade

Cleaning: Faulty Operation

The one common symptom of faulty operation at this step of the print cycle and its likely cause(s) are:

<u>Common Symptom</u>
Pages have random black dots, spots, stripes, or parts of the previous page.

<u>Likely Cause(s)</u>
• The cleaning blade is malfunctioning.
• The photosensitive drum is damaged and cannot be cleaned.

In both cases, replace the toner cartridge.
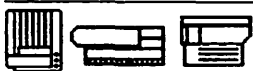
Practice Exercise 7

Directions

Practice Exercise 7 has two parts: A and B. Try to complete both exercises from memory.

Part A

The list below contains the six LaserWriter print cycle steps. Number the steps in the order in which they occur.

_____ Transfer

_____ Cleaning the drum

_____ Image formation

_____ Fusing

_____ Development

_____ Charging the drum

When you are ready, continue with Part B on the next page.

Practice Exercise 7

Directions: Part B

Match the names of the LaserWriter print cycle steps with the statement that describes the step. Write the letter of the step in front of the statement.

A. Transfer
B. Cleaning the drum
C. Image formation
D. Fusing
E. Development
F. Charging the drum

____ Produces an image of electrical charges on the photosensitive drum

____ Changes the image on the photosensitive drum to a visible image using toner

____ Removes residual toner from the photosensitive drum

____ Exposes the photosensitive drum to the preconditioning exposure lamps

____ Positively charged paper attracts the negatively charged toner from the photosensitive drum.

____ Toner particles permanently adhere to the paper.

____ Primary corona applies a uniform layer of negative charges over the surface of the photosensitive drum.

____ The light beam from the fiber-optic cables signals the DC controller to begin the next scan line.

____ Paper separates from the photosensitive drum.

____ Scanning mirror reflects the laser beam through focusing lenses.

When you finish, compare your answers with those on the next two pages.

Practice Exercise 7 (Answers)

Compare your answers to Part A with the answers below.

_4   Transfer

_6   Cleaning the drum

_2   Image formation

_5   Fusing

_3   Development

_1   Charging the drum

If you missed any items, please review the appropriate section of the module and correct any incorrect answers before you continue.

Practice Exercise 7 (Answers)

Compare your answers to Part B with the answers below.

A. Transfer
B. Cleaning the drum
C. Image formation
D. Fusing
E. Development
F. Charging the drum

C Produces an image of electrical charges on the photosensitive drum

E Changes the image on the photosensitive drum to a visible image using toner

B Removes residual toner from the photosensitive drum

F Exposes the photosensitive drum to the preconditioning exposure lamps

A Positively charged paper attracts the negatively charged toner from the photosensitive drum.

D Toner particles permanently adhere to the paper.

C Primary corona applies a uniform layer of negative charges over the surface of the photosensitive drum.

C The light beam from the fiber-optic cables signals the DC controller to begin the next scan line.

A Paper is separated from the photosensitive drum.

C Scanning mirror reflects the laser beam through focusing lenses.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

When you are ready, begin Practice Exercise 8 on the next page.

Practice Exercise 8

Directions

Complete Practice Exercises 8 and 9, and then check your answers against the answer pages that follow the exercises.

Indicate the likely causes of each print generation symptom statement in the space below each statement.

1. You are repairing a laser printer that generates blank pages. While troubleshooting the printer, you find that an image was created but not developed on the photosensitive drum. What are the likely print generation causes of this problem?

2. The laser printer you are repairing correctly develops the image on the photosensitive drum but does not transfer the image to the paper. What are the likely print generation causes of this problem?

3. The laser printer you are repairing correctly transfers the image to the paper, but the image easily smears or rubs off. What is/are the likely print generation cause(s) of this problem?

When you are ready, continue with Practice Exercise 9 on the next page.

Practice Exercise 9

Directions

Use the space below each statement to indicate the likely cause(s) of each page creation and print generation problem.

1. A customer just replaced her QuickDraw laser printer with a new PostScript laser printer. During your discussion you learn that she replaced the TrueType fonts with PostScript fonts, that she correctly connected her Macintosh to the printer by using LocalTalk cables and connectors, and that the printer is switched on. She also states that AppleTalk is active in the Chooser, and that her network is not divided into zones. She doesn't see the printer name in the Chooser. What is/are the likely cause(s) of this problem?

2. A customer says his new QuickDraw laser printer is printing much slower than it should. The files he is trying to print are one-page letters without graphics. The cables are correct, and the appropriate driver is installed and highlighted. What is/are the likely cause(s) of this problem?

3. The laser printer you are repairing does not print. While troubleshooting you do not find an image on the photosensitive drum. What is/are the likely cause(s) of this problem?

When you are ready, compare your answers to Practice Exercises 8 and 9 with those on the next two pages.
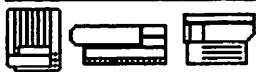
Practice Exercise 8 (Answers)

Compare your answers to Practice Exercise 8 with the answers below.

1. You are repairing a laser printer that generates blank pages. While troubleshooting the printer, you find that an image was created but not developed on the photosensitive drum. What are the likely print generation causes of this problem?

    The toner cartridge may be faulty or the toner tape may still be in the cartridge. The high-voltage power supply, which provides the voltage to the toner cartridge, is faulty. The DC controller malfunctioned and did not provide the signal to the high-voltage power supply.

2. The laser printer you are repairing correctly develops the image on the photosensitive drum, but does not transfer the image to the paper. What are the likely print generation causes of this problem?

    The corona wire, which attracts the toner to the paper, is damaged. The DC Controller did not provide the signal to the high-voltage power supply, which provides the voltage to the corona wire. The high-voltage power supply failed.

3. The laser printer you are repairing correctly transfers the image to the paper, but the image easily smears or rubs off. What is/are the likely print generation cause(s) of this problem?

    The fuser rollers may be worn. A faulty fuser bulb prevents the printer from coming to a ready state. The DC controller is malfunctioning and did not give the command to heat the fuser bulb.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.
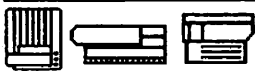
Practice Exercise 9 (Answers)

Compare your answers to Practice Exercise 9 with the answers below.

1. A customer just replaced her QuickDraw laser printer with a new PostScript laser printer. During your discussion you learn that she replaced the TrueType fonts with PostScript fonts, that she correctly connected her Macintosh to the printer by using LocalTalk cables and connectors, and that the printer is switched on. She also states that AppleTalk is active in the Chooser, and that her network is not divided into zones. She doesn't see the printer name in the Chooser. What is/are the likely cause(s) of this problem?

   The driver is not selected and/or the driver for her QuickDraw printer was not replaced with a driver for PostScript printers.

2. A customer says his new QuickDraw laser printer is printing much slower than it should. The files he is trying to print are one-page letters without graphics. The cables are correct, and the appropriate driver is installed and highlighted. What is/are the likely cause(s) of this problem?

   TrueType or 4x fonts are not installed for the fonts he wants to print.

3. The laser printer you are repairing does not print. While troubleshooting you do not find an image on the photosensitive drum. What is/are the likely cause(s) of this problem?

   The fiber-optic cable from the Laser/Scanner Assembly to the DC Controller is damaged. The DC Controller malfunctioned and did not send the required commands to the Laser/Scanner Assembly. The toner cartridge is damaged. (Remember, if the laser and/or scanning motor are faulty, the print cycle doesn't initiate.)

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

When you are ready, begin the next module—"Laser Printer Features."

Overview

Apple laser printer service technicians answer user questions, perform upgrades, and troubleshoot hardware- and software-related LaserWriter printer problems. To perform these tasks, you need to know the features and capabilities of Apple® LaserWriter® printers so you can efficiently service and support them.

Objectives

Upon completion of this module you will be able to:

1. Indicate the characteristics and functions common to both network and direct Apple LaserWriter printers.

2. Use module and Apple reference materials to identify LaserWriter printer features and specifications.

Module Organization

This module has three sections:

*   "Laser Printer Types" presents general categories of Apple LaserWriter printers and their similarities and differences.

*   "Laser Printer Families" details how Apple groups similar LaserWriter printers into families and how family members differ.

*   "Features and Specifications" presents the features and specifications you need to know to service and support Apple LaserWriter printers. You will also learn about Apple references that provide information about LaserWriter printer features.

Begin the first section of the module—"Laser Printer Types"—on the next page.

Laser Printer Types

Apple offers a variety of LaserWriter printers that have both common and unique features. Apple groups these features into two types: network and direct.

Network Laser Printers

Network printers can be connected to a network and shared by many users. Network cables connect between the users' computers and printers as Figure 2-1 shows. Apple network LaserWriter printers connect to several kinds of networks, including LocalTalk® and EtherTalk®. You will learn to connect a LaserWriter printer to a network in a later module of this course.
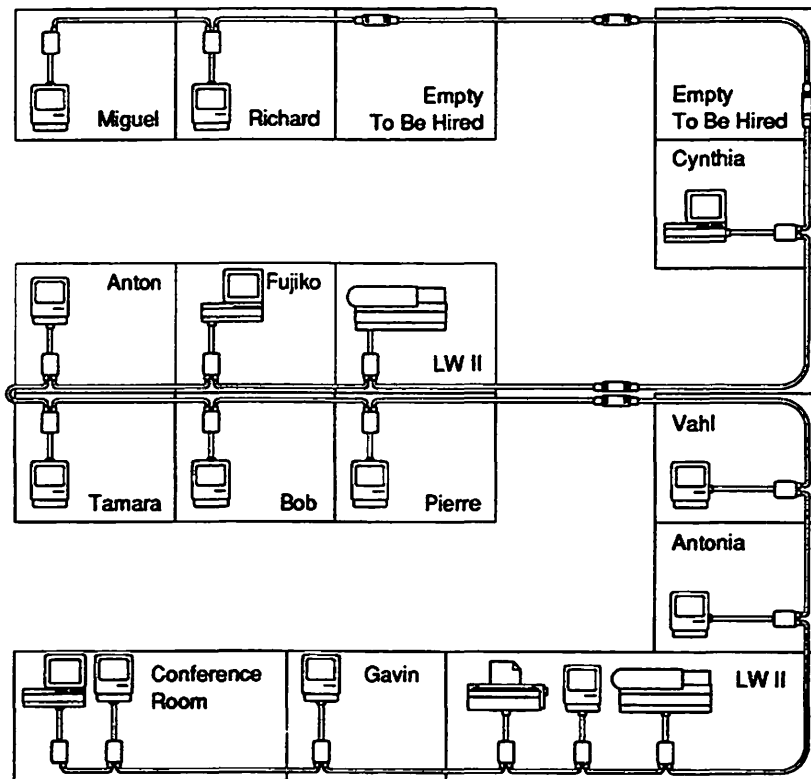
Figure 2-1
Apple laser printers can be shared by users

Laser Printer Types

Apple network LaserWriter printers normally use the PostScript page description language (or imaging language), which makes it easy to communicate with Apple computers that use PostScript.

Apple network LaserWriter printers can also operate in emulation mode. In emulation mode, the printer uses a different page description language, such as Hewlett-Packard's HP PCL4. This language allows Apple network LaserWriter printers to communicate with non-Apple computers that do not use the PostScript page description language. Users enable emulation mode by setting DIP or rotary switches, or using Apple LaserWriter printer utility software. The instructions for configuring the printer to operate in emulation mode are in the printer owner's manual.

Direct Laser Printers

Direct laser printers can only connect to a single computer and cannot be shared by users on a network. Direct laser printers connect to a computer using one of two connections: serial or SCSI.

You can connect some Apple direct LaserWriter printers to a computer modem or printer serial port. If you are connecting the printer to a Macintosh or Apple II computer, you can use the Apple serial cable, as Figure 2-2 shows.

Printer/Modem Port

Serial Cable
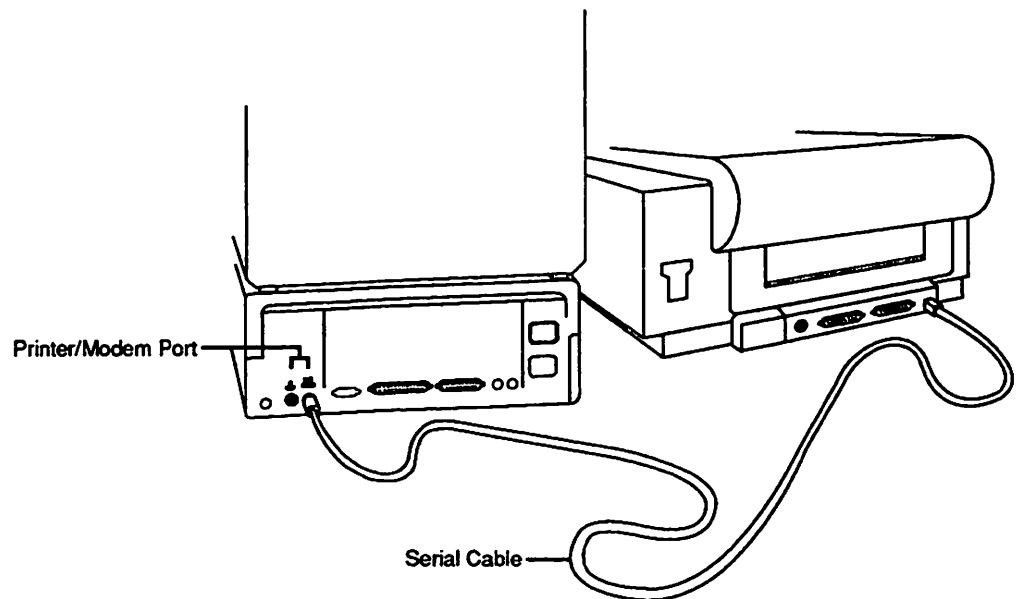
Figure 2-2
A serial LaserWriter printer connected to the computer serial port

Laser Printer Types

Note: Some network printers can also connect to a computer serial port. These printers offer the user a choice of connection types and allow simultaneous printer access to direct and network users.

Other Apple direct LaserWriter printers connect to a computer SCSI port, as Figure 2-3 shows. As with any Apple SCSI device, you must use correct SCSI termination, cabling, and ID numbers.

SCSI Port
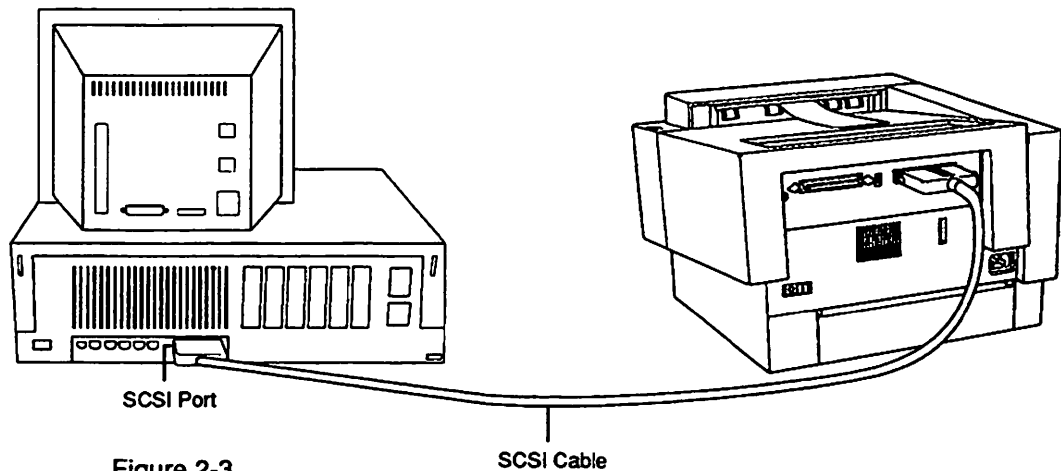
Figure 2-3   SCSI Cable
A direct LaserWriter printer connected to a Macintosh computer SCSI port

All Apple direct LaserWriter printers use the QuickDraw page description language. You learned about QuickDraw in the "Theory of Operation" module. Direct laser printers cannot operate in emulation mode (that is, they cannot use a page description language other than QuickDraw, such as Hewlett-Packard's HP PCL4) because they were designed to operate only with Apple computers.

Continue with Practice Exercise 1 on the next page.

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Practice Exercise 1

Directions

This exercise gives you an opportunity to identify the major features of networked and direct LaserWriter printers. Indicate the type of laser printer to which each of the following statements applies. Use the following key: N (network) or D (direct).

___ 1. Cannot operate in emulation mode

___ 2. Can operate in emulation mode

___ 3. Uses the QuickDraw page description language

___ 4. Uses the PostScript page description language

___ 5. Can connect to a computer using LocalTalk

___ 6. Can connect to a computer by using SCSI or serial cables

___ 7. Can be used with a non-Apple computer

___ 8. Can be used with an Apple computer only

___ 9. Can connect to a single computer only

___ 10. Can connect to one or more computers

When you finish, compare your answers with those on the following page.

Practice Exercise 1 (Answers)

Compare your answers to Practice Exercise 1 with the answers below.

__D__ 1. Cannot operate in emulation mode

__N__ 2. Can operate in emulation mode

__D__ 3. Uses the QuickDraw page description language

__N__ 4. Uses the PostScript page description language

__N__ 5. Can connect to a computer using LocalTalk

__D__ 6. Can connect to a computer by using SCSI or serial cables

__N__ 7. Can be used with a non-Apple computer

__D__ 8. Can be used with an Apple computer only

__D__ 9. Can connect to a single computer only

__N__ 10. Can connect to one or more computers

If you missed any items, please review "Laser Printer Types" and correct any incorrect answers before you continue.

When you are ready, begin the next section—"Laser Printer Families."

Laser Printer Families

Apple offers several laser printer families. A laser printer family is a group of laser printers that share the same print engine (the printer without the I/O PCB). For example, the Personal LaserWriter NT and the Personal LaserWriter SC printers use the same print engine, which Figure 2-4 shows.
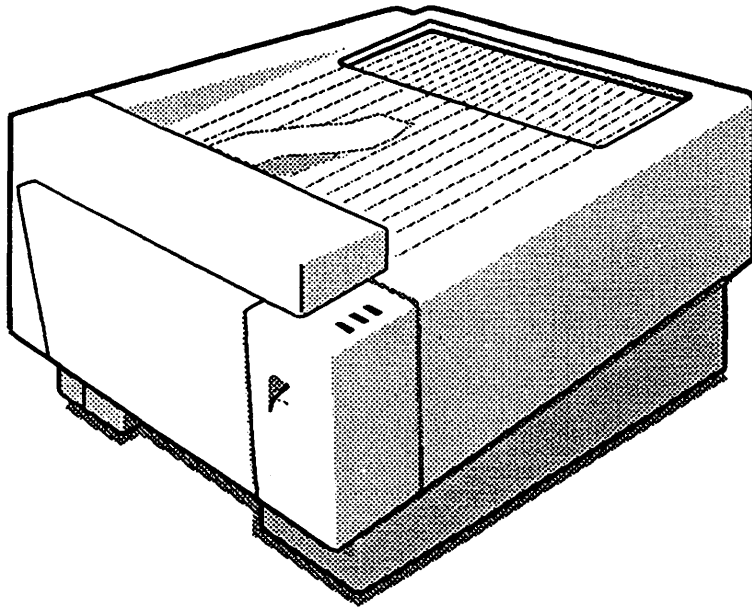
Figure 2-4
The Personal LaserWriter NT, SC, LS, and NTR print engine

The difference between laser printer family members is the I/O PCB. This design allows Apple to use the same print engine to support a variety of user needs. However, some laser printer family members have minor print engine differences, such as the location of the power switch. The differences are carefully noted in Apple reference materials.

Usually, a laser printer family contains a minimum of one network printer and one direct printer. The printer I/O PCB determines whether the printer is network or direct. A network LaserWriter printer has a network I/O PCB; a direct LaserWriter printer has a direct I/O PCB. Some laser printer families include two direct printers—one that connects to a computer SCSI port and another that connects to a computer serial port.

Laser Printer Families

Other families may include two network printers that have different I/O PCB features such as processor power and RAM. For example, one family may include a network printer with a 8 MHz microprocessor and 1 MB of RAM; another may have a 25 MHz microprocessor and 2 MB of RAM. Note that the features unique to each *member* of a laser printer family are not a result of print engine limitations; they are a result of I/O PCB differences.

The unique features of a laser printer *family* are determined by the print engine. For example, if one member of a laser printer family prints a maximum of eight pages per minute, all members of that family will print eight pages per minute whether they are network or direct printers. Figure 2-5 illustrates the relationship of laser printer types, families, and family members.

LASERWRITER II FAMILY

LaserWriter II

LASER PRINTER TYPES

Network   Direct

FAMILY MEMBERS

LaserWriter A
(8 MHZ, 2 MB of RAM)

LaserWriter B
(SCSI connect)

LaserWriter C
(25 MHZ, 5 MB of RAM)

PERSONAL LASERWRITER FAMILY

Personal LaserWriter

LASER PRINTER TYPES

Network   Direct

FAMILY MEMBERS

Personal LaserWriter A
(LocalTalk, Ethernet, etc.)

Personal LaserWriter B
(serial connect)

Personal LaserWriter C
(SCSI connect)
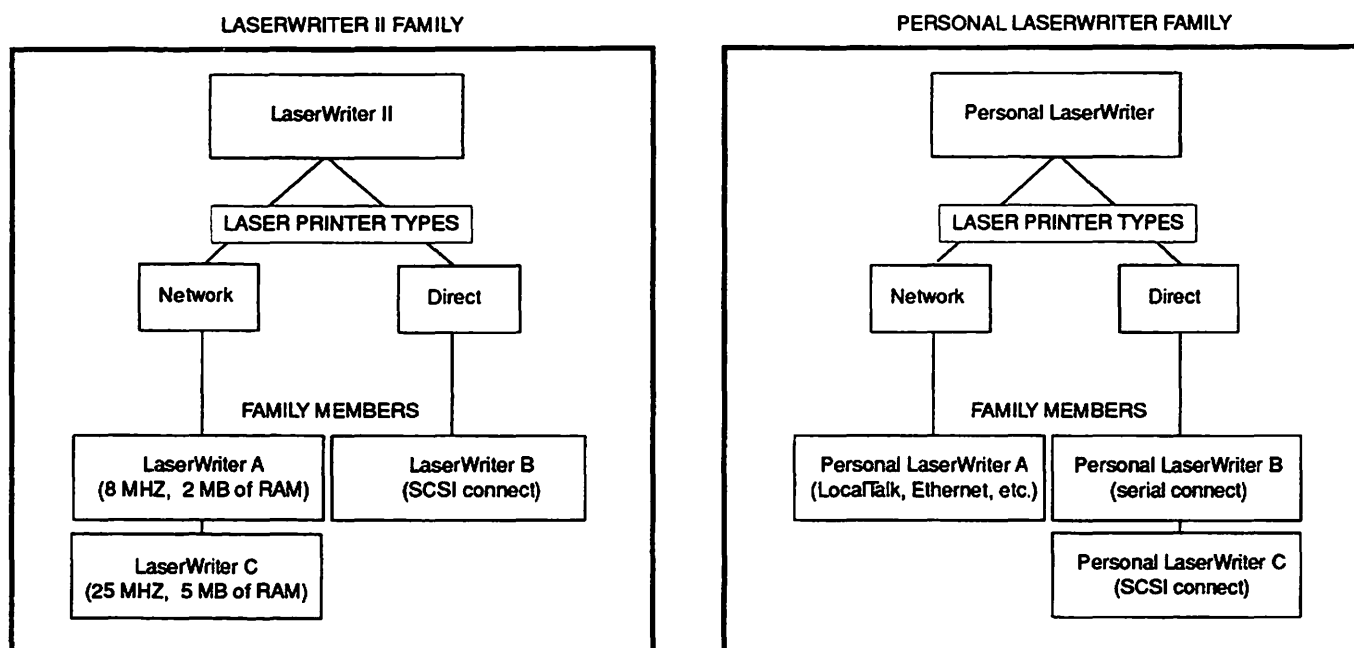
Figure 2-5
The relationship of laser printer types, families, and family members

Features and Specifications

This section presents the laser printer features and specifications that you need to know to set up, upgrade, and troubleshoot Apple LaserWriter printers and details where you can find information about laser printer features in Apple reference materials.

To set up and configure LaserWriter printers, you should be familiar with the printer ports, paper trays, display panel LEDs, and other features. It is important to know the different printer connection options (SCSI, LocalTalk, and serial) and how to set up each type of printer. You should know:

- Each port or connector and its function
- The features controlled by switches or software
- How and when to open access doors or paper trays
- How much paper a paper tray or cassette will hold

To perform upgrades, you must know the printer features that can be upgraded and the possible upgrade configurations. For example, if a user wants to increase the amount of printer RAM, you should know:

- Whether the printer RAM can be upgraded
- The amount of factory-installed printer RAM
- The amounts of RAM to which the factory-installed RAM can be upgraded

By exchanging the I/O PCB, you can upgrade a LaserWriter printer family member to a more-powerful member. For example, to upgrade the Apple LaserWriter IINT to a LaserWriter IIg, you remove the LaserWriter IINT I/O PCB and then install the LaserWriter IIg I/O PCB. Users who want to upgrade their printer will ask you about the feature differences between the two printers. To efficiently upgrade Apple LaserWriter printers you should know the following differences between laser printer families and family members:

- Microprocessor model and speed (for example, MC68030 at 25MHz)
- RAM amount (total and upgradeable)
- ROM amount
- Number and type of built-in fonts
- Pages printed per minute (ppm)
- Connection type (AppleTalk, SCSI, serial)
- Special features (font disk, PhotoGrade, etc.)
- Paper-handling features (cassette size, paper trays, number of sheets, etc.)

Features and Specifications

When you troubleshoot Apple LaserWriter printers, it is important to know the printer features and operating specifications. For example, a user may be experiencing print quality problems because he or she is using a type of paper that does not work well with the printer. To troubleshoot this problem, you need to know which types of paper work well with the printer. To troubleshoot laser printers, you should know:

- The location of the access door release button
- The location of printer cables and how they connect to the printer
- The location of the service test print button
- The location of LED indicators and their functions
- The location of the power switch
- The appearance of a normal user test page

Note: This is not a complete list. You will learn more about these features in the "Set Up" and "Troubleshooting Basics" modules of this course.

Apple Reference Materials

Apple offers the following reference materials about laser printer features:

- Owner's manuals
- *Apple Service Source* compact disc
- *Apple Service Guide for LaserWriter Printers*
- AppleLink

The laser printer owner's manuals include the following information:

- Step-by-step set-up instructions
- Features that can be upgraded
- Basic troubleshooting procedures

Owner's manuals are the only reference that users receive; technicians can gauge users' laser printer knowledge by becoming familiar with the owner's manual.

The *Service Source* compact disk is the most comprehensive service reference for Apple products. *Service Source* is organized into manuals and chapters. To find information about laser printer features and specifications, do the following:

Features and Specifications
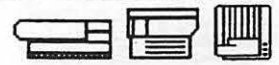
1. From the *Service Source* Main Menu, choose **Laser Printers** from the Manuals menu. From the Laser Printers submenu, choose a LaserWriter family as Figure 2-6 shows.
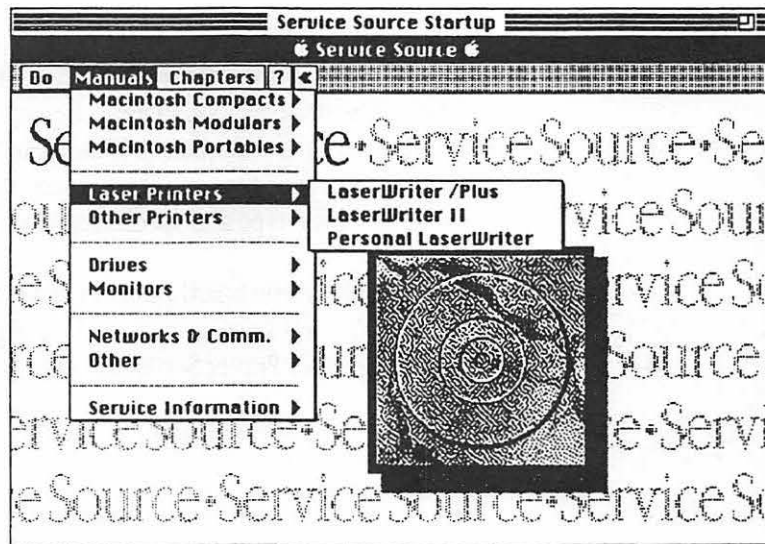
Figure 2-6
The *Service Source* Manuals menu

3. Pull down the Chapters menu, as Figure 2-7 shows. Choose **Specifications**.
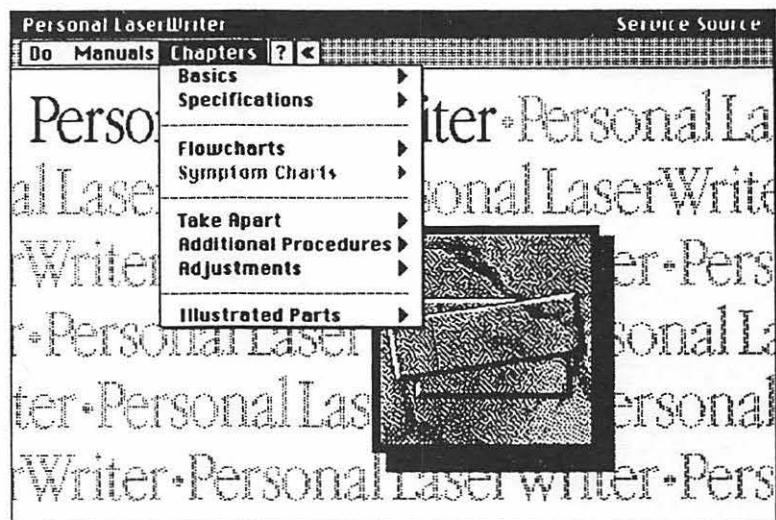
Figure 2-7
The *Service Source* Personal LaserWriter Chapters menu

Features and Specifications

The *Apple Service Guide for LaserWriter Printers* is a condensed booklet of the most commonly referenced material in *Service Source*. The features and specifications sections are easy to access when *Service Source* is not available or when you need to get information quickly.

Lastly, AppleLink is an excellent source of late-breaking laser printer technical information. New troubleshooting news appears on AppleLink before it appears in other Apple references. Various AppleLink libraries and bulletin boards contain Apple LaserWriter printer specification sheets. These sheets include information about RAM, ROM, microprocessor type and speed, upgrades, and more.

Note: Library and bulletin board names change often, so Apple does not list the names in this course. You will learn more about locating LaserWriter printer information on AppleLink in the Laser Printer Service Course.

Continue with Practice exercise 2 on the next page.

Practice Exercise 2

Directions

Follow the steps below to complete the features and specifications chart in this exercise.

1. Choose two LaserWriter printers from different families and write their names in the space provided in the "LaserWriter_____" box.

2. Locate the appropriate LaserWriter owner's manuals, *Service Source*, and AppleLink.

3. Use the Apple references to fill in the boxes.

Feature/ Specification	LaserWriter_____	LaserWriter_____
Microprocessor		
RAM		
ROM		
Pages per Minute (PPM)		
Printer Connection Types		
Page Description/ Imaging Language		
Number of Built-in Fonts		

When you are ready, continue with the next module—"Set Up"—on the following page.

Overview

This module teaches you to set up network and direct LaserWriter printers. The information and skills you learn will help you troubleshoot problems caused by improper set up.

Objectives

At the conclusion of this module, you will be able to:

- Set up three types of laser printers and print a startup test page

- Answer questions about setting up Apple laser printers

- Indicate how to set up network and direct LaserWriter printers with a variety of hardware configurations

Module Organization

This module has five sections:

"Prepare the LaserWriter Printer" lists the three major steps for setting up any Apple LaserWriter printer.

"Network Set Up" lists the procedures for connecting a LaserWriter printer to LocalTalk or EtherTalk. You will practice the set-up procedures using the printer owner's manual, and then complete a written exercise.

"Serial Set Up" lists the procedures for setting up a LaserWriter printer serial port connection. You will practice the set-up procedures using the printer owner's manual, and then complete a written exercise.

"SCSI Set Up" lists the procedures for setting up a LaserWriter printer SCSI port connection. You will practice the set-up procedures using the printer owner's manual, and then complete a written exercise.

Overview

Additional Equipment and Materials

To perform the hands-on practice exercises in this module, you must provide the following equipment and materials:

- Network LaserWriter printer
- Direct, serial LaserWriter printer
- Direct, SCSI LaserWriter printer
- Owner's manual for each of three types of LaserWriter printers
- Toner cartridge, paper, and cables as specified by the owner's manual
- Macintosh computer with system software 6.0.7 or later

Do not begin the module until you have the materials in this list.

Begin the first section of the module—"Prepare the LaserWriter"—on the next page.

Prepare the LaserWriter

You must complete three major steps to set up any LaserWriter (the steps are the same for all LaserWriter printers):

1. Prepare the LaserWriter printer.
2. Connect the LaserWriter printer.
3. Install the software.

To prepare a LaserWriter printer for set up, perform the procedures below. You must complete the first three in order. You may not need to complete some of the procedures if a LaserWriter printer was moved and set up in a new location.

1. Find a location that meets the space and environmental conditions in the owner's manual.

2. Remove the LaserWriter printer and all other items from the shipping carton.

3. Remove the retainers and cushioning materials from the LaserWriter printer.

4. Install the I/O board (if the I/O board ships separately). Remember to follow ESD safety rules.

5. Install the toner cartridge. Remove the toner tape if the cartridge is new.

6. Load the paper cassette tray with paper and install the tray in the LaserWriter printer.

Some LaserWriter printers may require that you complete one or both of the following additional procedures:

• Install the cleaning pad in the fuser assembly.

• Install the optional paper feeder.

Network Set Up

The second and third major steps in setting up a LaserWriter differ for each printer and depend on how the LaserWriter printer communicates with the computer.

As you learned in a previous module, network LaserWriter printers can connect to different types of networks—including LocalTalk, Ethernet, and Token Ring. In this section, you will learn to connect a LaserWriter to either an LocalTalk or Ethernet network and install the appropriate software. If you do not have access to an existing network, you can connect the LaserWriter to a single Macintosh.

To connect the LaserWriter to a LocalTalk or Ethernet network, complete the following procedures:

1. Make sure all devices on the network are switched off before connecting the LaserWriter to the network.

2. Connect a LocalTalk or EtherTalk connector box to each device.

3. Connect each connector box by using LocalTalk or Ethernet cables. Figure 3-1 shows a LocalTalk connection.
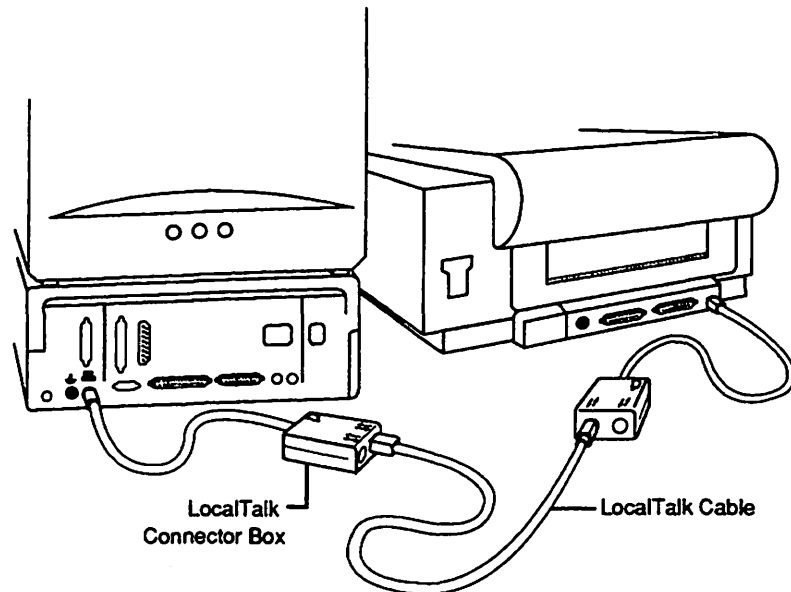
Figure 3-1
The Macintosh-to-LaserWriter LocalTalk connection

Network Set Up

4. Set switches to AppleTalk or EtherTalk (as required by some LaserWriters).

5. Connect the power cable to the printer and to the electrical outlet.

6. Switch on the LaserWriter printer.

   A startup test page, as Figure 3-2 shows, prints automatically every time a network laser printer is switched on.

Service Training

LASERWRITER II NTX

Post Script

AppleTalk

35 fonts in ROM

2 MB RAM

20MB SCSI device
22 fonts on external device

68000
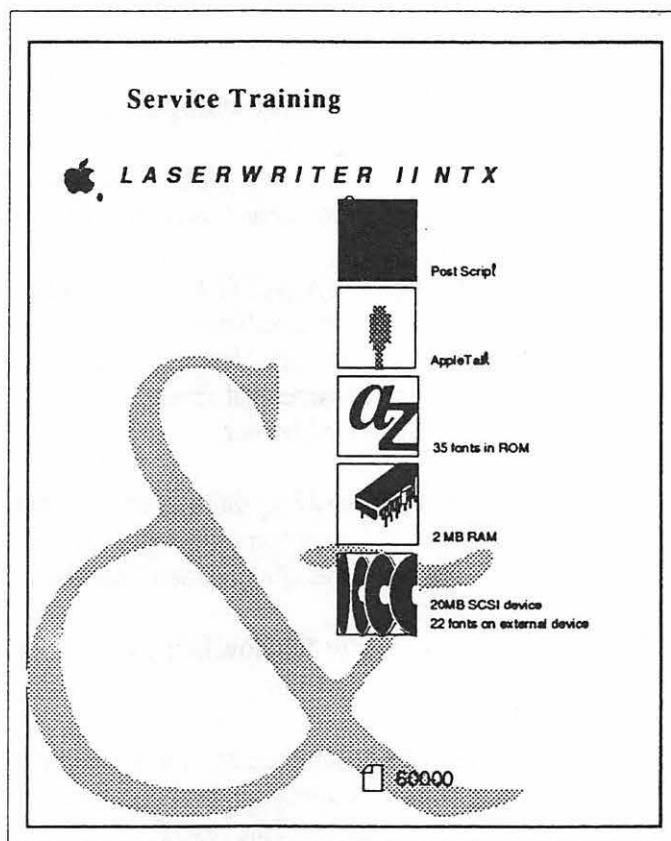
Figure 3-2
A networked LaserWriter startup test page

Network Set Up

To install the software that network LaserWriter printers require, complete the following procedures:

1. Switch on the computer.

2. Use the Installer utility software that came with the printer to install the network printer driver and fonts.

3. Install the EtherTalk software—if you are connecting to an EtherTalk network, use the Installer utility software that came with the computer. This step is not necessary for AppleTalk networks; AppleTalk network software is built into the Macintosh computer.

4. Open the Network control panel and select EtherTalk (if you are connecting to an EtherTalk network).

5. Open the Chooser and complete these steps to select a printer:

   • Click the AppleTalk Active button if it is not already selected.
   • Select the LaserWriter icon for networked LaserWriter printers.
   • Click the name of the printer you wish to use from the list of LaserWriter printer names that appear.
   • Close the Chooser.

6. Use the *LaserWriter Utility* application to name the LaserWriter printer. If more than one LaserWriter printer is connected to the network, give each printer a different name. Quit the LaserWriter Utility.

7. Choose **Print Window** from the File menu. When the dialog box appears, click **OK** to print the window.

Note: If other computers are connected to the network, each computer must use the same version of LaserWriter printer software. For systems using system software 6.1 or lower, you must install the Laser Prep file.

When the necessary software is installed and a normal-looking page prints, the LaserWriter printer is set up and ready to use.

Continue with Practice Exercise 1 on the next page.

Practice Exercise 1

Directions: Part A

This exercise has two parts: A and B. In Part A, you will practice setting up a LaserWriter and Macintosh on a LocalTalk or Ethertalk network. Before you begin, gather the following equipment and materials:

- Macintosh computer (with system software version 6.0.7 or later)
- Network LaserWriter
- LaserWriter toner cartridge
- LaserWriter paper
- LaserWriter owner's manual
- All necessary cables (as specified in the owner's manual)
- LaserWriter Installer disks (as specified by the owner's manual)
- EtherTalk card (optional)
- EtherTalk Installer disk (optional)
- EtherTalk card (optional)

To complete this exercise, do the following:

1. Locate the owner's manual—the owner's manual lists step-by-step procedures for setting up a LaserWriter printer on a network. For each of the following steps, read and perform the procedures in the owner's manual.

2. Prepare the LaserWriter printer.

3. Connect the LaserWriter printer—if you have a LocalTalk or EtherTalk network, connect the LaserWriter to the network. If you do not have a network, connect a single Macintosh computer to the LaserWriter printer.

4. Install the software—if you are connecting to a LocalTalk network, use the LaserWriter Installer disks. If you are connecting to an EtherTalk network, use the disk that comes with the EtherTalk card.

5. Print a window—from the Macintosh computer desktop, open any window and choose **Print Window** from the File menu. Be sure you first select the proper printer driver and name in the Chooser.

When you have printed a directory, you have completed Part A of this exercise. If you have problems, refer to the Troubleshooting section of the owner's manual.

Continue with Part B on the next page.

Practice Exercise 1

Directions: Part B

Assume you are setting up a single Macintosh computer that runs system software 6.0.7 or later, and a networked LaserWriter using LocalTalk. Place an X next to each statement that describes how to set up the Macintosh computer and LaserWriter printer.

___ Select a location for the LaserWriter printer and remove all hardware, software, and materials from the shipping carton.

___ Remove retainers and cushioning materials from the LaserWriter printer.

___ Install the toner cartridge and remove toner tape.

___ Load paper into the paper tray and install the tray into the LaserWriter printer.

___ Connect a serial cable from the computer to the LaserWriter printer.

___ Connect a LocalTalk connector box to the computer and the LaserWriter, and use a LocalTalk cable to connect the boxes.

___ Connect the power cord.

___ Switch on the LaserWriter printer to generate a startup test page.

___ Switch on the LaserWriter printer (no startup test page will appear).

___ Set the SCSI ID number to 7. Switch on the LaserWriter to generate a startup test page.

___ Install the TrueType fonts.

___ Install the network LaserWriter printer driver (version 6.1 or higher).

___ Install the appropriate direct LaserWriter printer driver (version 6.1 or higher).

___ Install Laser Prep (not required with LaserWriter printer driver version 6.1 or higher).

___ Open the Chooser and select the network LaserWriter icon.

___ Open the Chooser and select the appropriate direct LaserWriter icon.

Compare your answers with those on the following page.

Practice Exercise 1 (Answers)

Compare your answers to Practice Exercise 1, Part B, with the answers below.

_X_ Select a location for the LaserWriter printer and remove all hardware, software, and materials from the shipping carton.

_X_ Remove retainers and cushioning materials from the LaserWriter printer.

_X_ Install the toner cartridge and remove the toner tape.

_X_ Load paper into the paper tray and install the tray into the LaserWriter printer.

___ Connect a serial cable from the computer to the LaserWriter printer.

_X_ Connect a LocalTalk connector box to the computer and the LaserWriter, and use a LocalTalk cable to connect the boxes.

_X_ Connect the power cord.

_X_ Switch on the LaserWriter printer to generate a startup test page.

___ Switch on the LaserWriter printer (no startup test page will appear).

___ Set the SCSI ID number to 7. Switch on the LaserWriter to generate a startup test page.

___ Install the TrueType fonts.

_X_ Install the network LaserWriter printer driver (version 6.1 or higher).

___ Install the appropriate direct LaserWriter printer driver (version 6.1 or higher).

___ Install Laser Prep (not required with LaserWriter printer driver version 6.1 or higher).

_X_ Open the Chooser and select the network LaserWriter icon.

___ Open the Chooser and select the appropriate direct LaserWriter icon.

If you missed any items, please review this section before you continue and correct any incorrect answers.

When you are ready, begin the next section—"Serial Set Up"–on the following page.

Serial Set Up

Direct, serial-connect LaserWriter printers connect to the Macintosh computer printer port. If the printer port is already in use, you can use the modem port. To connect the LaserWriter printer to the printer port, complete the following procedures:

1. Make sure the LaserWriter printer and computer are switched off before you connect them.

2. Connect one end of a serial cable to the serial port on the LaserWriter.

3. Connect the other end of the serial cable to the printer (or modem) port on the computer, as Figure 3-3 shows.
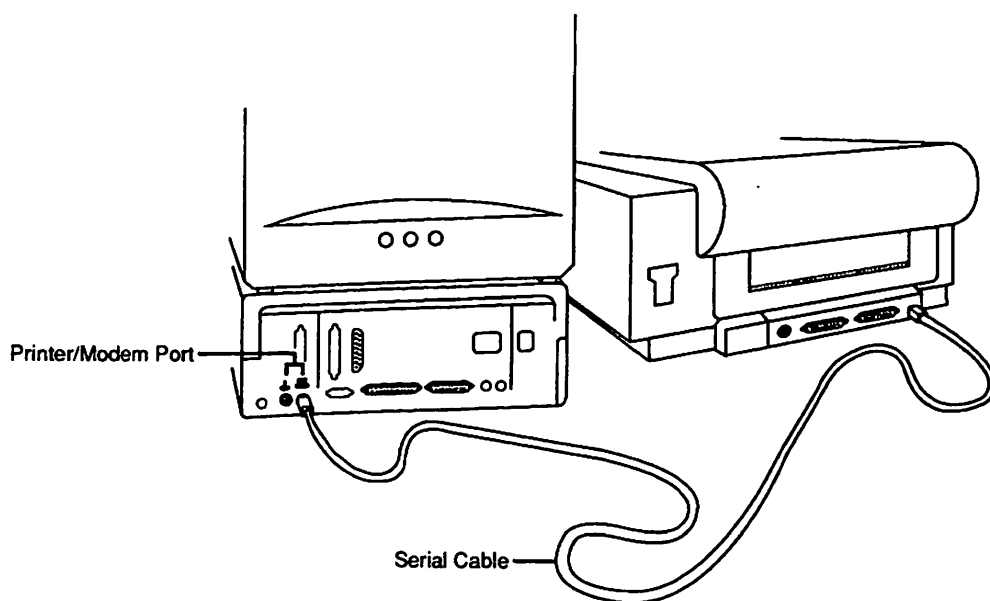
Figure 3-3
The Macintosh and LaserWriter serial port connection

4. Connect the power cable to the printer and to the electrical outlet.

5. Switch on the LaserWriter.

The startup test page does not print with direct, serial LaserWriter printers.

Serial Set Up

To install the software that direct, serial LaserWriter printers require, complete the following procedures:

1. Switch on the LaserWriter printer and the computer.

2. Use the Installer utility software that came with the printer to install the direct, serial LaserWriter printer driver in the System Folder.

3. Install the serial LaserWriter Prep file in the System Folder.

4. Install the TrueType fonts.

5. Open the Chooser—select the direct, serial LaserWriter icon. No printer name will appear. If you have a serial-connect printer connected to both Macintosh computer serial ports, use the Chooser to select the port from which to print.

6. Close the Chooser.

7. From the desktop, choose **Print Window** from the File menu. Click **OK** in the dialog box to print the window. When the window prints successfully, the printer is ready to use.

Continue with Practice Exercise 2 on the following page.

Practice Exercise 2

Directions: Part A

In Part A of this exercise you will practice setting up a serial-connect LaserWriter printer and Macintosh computer. Before you begin, gather the following equipment and materials:

- Macintosh computer (system software version 6.0.7 or later)
- Serial LaserWriter printer
- LaserWriter printer toner cartridge
- LaserWriter printer paper
- LaserWriter printer owner's manual
- Necessary cables (as specified in the owner's manual)
- LaserWriter Installer disks (as specified in the owner's manual)

To complete this exercise, do the following:

1. Locate the owner's manual—the owner's manual lists step-by-step procedures for setting up a LaserWriter printer. For each of the following steps, read and perform the procedures in the owner's manual.

2. Prepare the LaserWriter printer.

3. Connect the LaserWriter printer.

4. Install the software.

5. Print a window—from the Macintosh desktop, open any window and choose **Print Window** from the File menu. Be sure you first select the proper printer driver and name in the Chooser.

When you have printed a window, you have completed this part of the exercise. If you have problems, refer to the Troubleshooting section of the owner's manual.

Continue with Part B on the next page.

Practice Exercise 2

Directions: Part B

Assume you are setting up a single Macintosh computer using system software version 6.0.7 or later, and a serial-connect LaserWriter printer. Place an X next to each statement that describes how to set up the Macintosh computer and LaserWriter printer.

_____ Select a location for the LaserWriter printer and remove all hardware, software, and materials from the shipping carton.

_____ Remove retainers and cushioning materials from the LaserWriter printer.

_____ Install the toner cartridge and remove the toner tape.

_____ Load paper into the paper tray and install the tray into the LaserWriter printer.

_____ Connect a SCSI cable from the computer to the LaserWriter printer.

_____ Connect a serial cable from the computer to the LaserWriter printer.

_____ Connect a LocalTalk connector box to the computer and the LaserWriter printer, and use a LocalTalk cable to connect the boxes.

_____ Connect the power cord.

_____ Switch on the LaserWriter to generate a startup test page.

_____ Switch on the LaserWriter (no startup test page will print).

_____ Set the SCSI ID number to 7. Switch on the LaserWriter to generate a startup test page.

_____ Install the network LaserWriter printer driver (version 6.1 or higher).

_____ Install the appropriate direct LaserWriter driver (version 6.1 or higher).

_____ Install Laser Prep (not required with LaserWriter driver version 6.1 or higher).

_____ Install Serial Prep.

_____ Install the TrueType fonts.

_____ Open the Chooser and select the appropriate direct LaserWriter icon.

Compare your answers with those on the following page.

Practice Exercise 2
(Answers)

Compare your answers to Practice Exercise 2, Part B, with the answers below.

_X_ Select a location for the LaserWriter printer and remove all hardware, software, and materials from the shipping carton.

_X_ Remove retainers and cushioning materials from the LaserWriter printer.

_X_ Install the toner cartridge and remove toner tape.

_X_ Load paper into the paper tray and install the tray into the LaserWriter printer.

___ Connect a SCSI cable from the computer to the LaserWriter printer.

_X_ Connect a serial cable from the computer to the LaserWriter printer.

___ Connect a LocalTalk connector box to the computer and the LaserWriter printer, and use a LocalTalk cable to connect the boxes.

_X_ Connect the power cord.

___ Switch on the LaserWriter to generate a startup test page.

_X_ Switch on the LaserWriter (no startup test page will print).

___ Set the SCSI ID number to 7. Switch on the LaserWriter to generate a startup test page.

___ Install the network LaserWriter printer driver (version 6.1 or higher).

_X_ Install the appropriate direct LaserWriter driver (version 6.1 or higher).

___ Install Laser Prep (not required with LaserWriter driver version 6.1 or higher).

_X_ Install Serial Prep.

_X_ Install the TrueType fonts.

_X_ Open the Chooser and select the appropriate direct LaserWriter icon.

If you missed any items, please review this section and correct any incorrect answers before you continue. **When you are ready, continue with the next section—"SCSI Set Up"—on the following page.**

SCSI Set Up

Direct, SCSI LaserWriters connect to the computer in the same way as other SCSI devices. To connect the LaserWriter printer to the computer SCSI port, follow these procedures (if the SCSI port is in use, you can use the modem port):

1. Make sure the computer and the LaserWriter printer are switched off.

2. Install the I/O board (if the printer ships without the I/O board). Remember to follow ESD safety rules.

3. Connect the SCSI cable to the computer.

4. Connect the SCSI (or peripheral) cable to the LaserWriter, as Figure 3-4 shows.
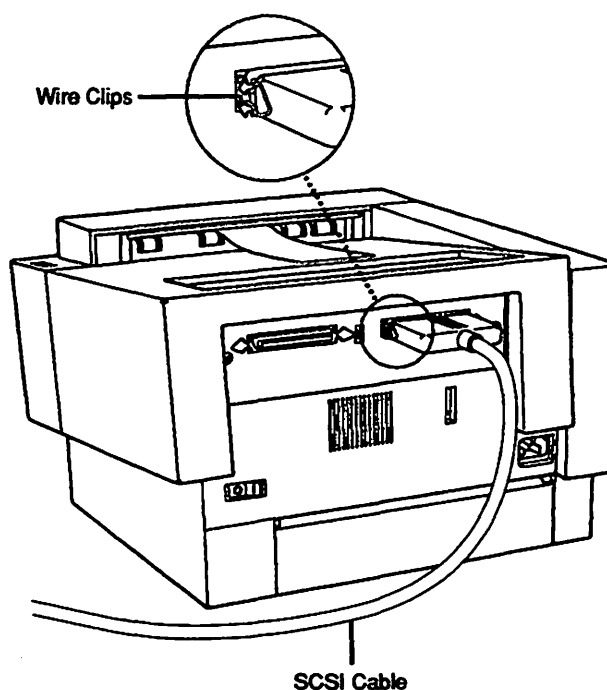
Figure 3-4
The Personal LaserWriter SC SCSI connection

Follow these guidelines when connecting a LaserWriter to the SCSI port:

• Follow proper SCSI termination procedures.
• Select the SCSI identification (ID) number you wish to assign to the LaserWriter printer and record the number for later reference.

SCSI Set Up

- Set the LaserWriter SCSI ID number to seven (7). The LaserWriter ID number must be 7 for the LaserWriter to print a startup test page. Since the Macintosh SCSI ID number is always 7, once you generate the startup test page, you must reset the LaserWriter SCSI ID number to the one you selected in the previous step.

5. Connect the power cable to the printer and to the electrical outlet.

6. Switch on the LaserWriter to generate a startup test page, as Figure 3-5 shows.
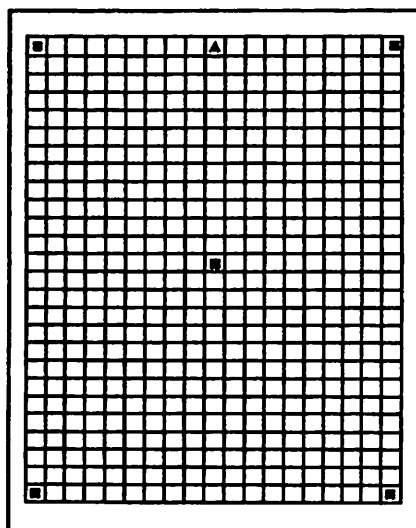
Figure 3-5
The Personal LaserWriter SC startup test page

If the SCSI ID number is 7, the startup test page in Figure 3-5 prints automatically. The startup test page differs from the networked LaserWriter startup page.

Warning: SCSI startup test pages print continuously. To stop printing, remove the paper cassette, allow the last page to exit the printer, switch the printer off, and reset the SCSI ID to a different number.

SCSI Set Up

To install the software required by direct, SCSI-connect LaserWriter printers, complete the following procedures:

1. Switch on the LaserWriter printer and the computer.

2. Install the appropriate direct LaserWriter printer driver and fonts in the System Folder.

3. Install the 4x fonts (if TrueType fonts are installed, skip this step).

4. Open the Chooser.

5. Select the driver with the direct, SCSI icon—such as the Personal LaserWriter SC or the LaserWriter IISC. When one SCSI-configured LaserWriter printer is connected to the computer, no printer name appears in the right window in the Chooser.

6. Close the Chooser.

7. Choose **Print Window** from the File menu and click **OK** in the print dialog box.

    When the necessary software is installed and a normal-looking page prints, the LaserWriter printer is ready to use.

8. Switch off the LaserWriter.

9. Reset the LaserWriter SCSI ID number to the one you originally selected.

Continue with Practice Exercise 3 on the next page.

Practice Exercise 3

Directions: Part A

In Part A of this exercise you will practice setting up a SCSI-connect LaserWriter and Macintosh. Before you begin, gather the following equipment and materials.

- Macintosh computer (system software version 6.0.7 or later)
- SCSI LaserWriter printer
- LaserWriter printer toner cartridge
- LaserWriter printer paper
- LaserWriter printer owner's manual
- Necessary cables (as specified in the owner's manual)
- LaserWriter Installer disks (as specified in the owner's manual)

To complete this exercise:

1. Locate the owner's manual—the owner's manual lists step-by-step procedures for setting up a LaserWriter printer. For each of the following steps, read and perform the procedures in the owner's manual.

2. Prepare the LaserWriter printer.

3. Connect the LaserWriter printer.

4. Install the software.

5. Print a window—from the Macintosh computer desktop, open any window and choose **Print Window** from the File menu. Be sure you first select the proper printer driver and name in the Chooser.

When you have printed a window, you have completed this part of the exercise. If you have problems, refer to the Troubleshooting section of the owner's manual.

Continue with Part B on the following page.

Practice Exercise 3

Directions: Part B   Assume that you are setting up a single Macintosh computer that uses system software 6.1 or later, and a direct, SCSI LaserWriter printer. Place an X next to each statement that describes how to set up the Macintosh computer and LaserWriter printer.

_____ Remove retainers and cushioning materials from the LaserWriter printer.

_____ Install the toner cartridge and remove toner tape.

_____ Load paper into the paper tray and install the tray in the LaserWriter printer.

_____ Connect a serial cable from the computer to the LaserWriter printer.

_____ Connect a SCSI cable from the computer to the LaserWriter printer.

_____ Connect the power cord.

_____ Switch on the LaserWriter printer to generate a startup test page.

_____ Switch on the LaserWriter (no startup test page will print).

_____ Set the SCSI ID number to 7. Switch on the LaserWriter printer to generate a startup test page.

_____ Install the network LaserWriter driver (version 6.1 or higher).

_____ Install the appropriate direct LaserWriter printer driver (version 6.1 or higher).

_____ Install Serial Prep.

_____ Install the TrueType fonts.

_____ Open the Chooser and select the appropriate direct LaserWriter icon.

_____ Switch off the printer.

_____ Select a nonconflicting SCSI ID number.

Compare your answers with those on the following page.

Practice Exercise 3 (Answers)

Compare your answers to Practice Exercise 3, Part B, with the answers below.

_X_ Remove retainers and cushioning materials from the LaserWriter printer.

_X_ Install the toner cartridge and remove toner tape.

_X_ Load paper into the paper tray and install the tray in the LaserWriter printer.

___ Connect a serial cable from the computer to the LaserWriter printer.

_X_ Connect a SCSI cable from the computer to the LaserWriter printer.

_X_ Connect the power cord.

___ Switch on the LaserWriter printer to generate a startup test page.

___ Switch on the LaserWriter (no startup test page will print).

_X_ Set the SCSI ID number to 7. Switch on the LaserWriter printer to generate a startup test page.

___ Install the network LaserWriter driver (version 6.1 or higher).

_X_ Install the appropriate direct LaserWriter printer driver (version 6.1 or higher).

___ Install Serial Prep.

_X_ Install the TrueType fonts.

_X_ Open the Chooser and select the appropriate direct LaserWriter icon.

_X_ Switch off the printer.

_X_ Select a nonconflicting SCSI ID number.

If you missed any items, please review this section of the module and correct any incorrect answers before you continue.

When you are ready, begin the last module—"Troubleshooting Basics"—on the next page.

Overview

This final module presents a general process for troubleshooting all Apple laser printers. In previous modules, you learned about Apple laser printer features, setup procedures, and general printer operation. This module teaches you to use this information to troubleshoot and resolve laser printer problems over the telephone or when talking to customers in person. This module does not teach you to take apart laser printers or replace modules and parts, but does introduce you to the entire troubleshooting and repair process.

Objectives

1. Identify and describe the major steps of the laser printer troubleshooting process.

2. Indicate when to use each troubleshooting resource and how to use the troubleshooting job aid.

3. Identify customer problem statements that clearly describe a deviation from normal operation.

4. Identify at least one question to ask a customer with an unclear problem. The question should help him/her identify the actual deviation from normal operation.

5. Identify guidelines for working with a customer with a specific level of computer and laser printer knowledge.

6. Complete the following tasks in ten minutes or fewer after receiving a customer call:

   a. Establish the deviation from normal operation.
   b. Take action to resolve the problem.
   c. Determine if the problem is resolved. Decide whether to go on-site or to have the customer bring the printer to the service center.

Module Organization

This module has five sections:

- "Overview" introduces this module.

- "General Troubleshooting" reviews the seven general troubleshooting steps common to troubleshooting all Apple products and presents the laser printer troubleshooting process.

- "Telephone Troubleshooting" provides techniques for identifying, isolating, and resolving laser printer problems over the telephone or when talking with the customer in person.

Overview

- "Hands-On Troubleshooting" provides hands-on techniques for further isolating and resolving laser printer problems that cannot be resolved over the telephone.

- "Working With the Customer" provides guidelines for adapting the troubleshooting process for working with customers that have different levels of computer and laser printer knowledge.

Begin the first section—"General Troubleshooting"—on the next page.

General Troubleshooting

Troubleshooting Apple laser printers is like troubleshooting any Apple product. First we'll review the general troubleshooting process and then apply it to laser printers. You may already be familiar with the general troubleshooting process, but it is important to remind yourself of the major steps to ensure you apply them when troubleshooting laser printers.

You should follow the seven major steps in the list below when troubleshooting any Apple product. The actions within each step are listed in the order in which you should perform each action. As you gain troubleshooting experience, you may decide to complete the actions in a sequence that reflects your experience. Take a few minutes to thoroughly review each step.

1. Complete initial administrative tasks (as they apply to your service center):

   - Determine Apple Warranty coverage.
   - Complete the AppleOrder Service Repair Order (SRO).
   - Back up data.

2. Identify and isolate the problem:

   - Determine the deviation from normal operation. By telephone or in person, ask the customer questions, listen carefully, and take notes.

   - Isolate the cause of the problem. By telephone or in person, re-create intermittent problems.

   - Try quick fixes as appropriate. Check cables, adjust controls, ensure proper installation, and check for visually damaged or dirty parts.

   - Systematically search for the problem using the troubleshooting resources:

     - Be familiar with and use self-tests, diagnostic software, *Service Source*, owner's guides, your log of common problems, customer records, software update manuals, AppleLink libraries and bulletin boards, and Apple Technical Support.

     - Identify a suspect module or part.

3. Resolve the problem:

   - Replace modules.
   - Make adjustments.
   - Instruct the user.
   - Perform preventive maintenance.
   - Reassemble.
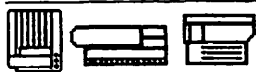
General Troubleshooting

4. Test the system—run diagnostics overnight and perform basic functions.

5. Complete paperwork (as appropriate for your service center):

   - Complete the AppleOrder SRO form.
   - Update your own log of common problems.
   - Update the customer's file.
   - Inform Apple service support personnel about bugs you discover.

6. Pack and ship defective modules if necessary (and as appropriate for your service center):

   - Refer to the service programs information in *Service Source* for shipping-and-packaging guidelines.
   - Use exact or duplicate Apple packaging.
   - Ship the repair paperwork with the defective module.

7. Inform the user.

   - Explain the cause of the problem to the user.
   - Test the system in front of the user.
   - Instruct and caution the user, if appropriate.
   - Promote AppleCare®, if appropriate.
   - Follow up on the problem.

Troubleshooting Apple laser printers is like troubleshooting other Apple products in that you should carefully complete each of these seven troubleshooting steps.

The remaining sections of this module focus on steps 2, 3, and 4 and present a two-part laser printer troubleshooting process. The first part—"Telephone Troubleshooting"—details the process of identifying, isolating, and resolving (if possible) printing problems over the telephone or when talking to customers in person. The second par,—"Hands-On Troubleshooting"—details the process of isolating and resolving problems that require you to service the laser printer at the service center or on-site.

General Troubleshooting

The overall troubleshooting process—including telephone and hands-on troubleshooting—is illustrated in Figure 4-1.
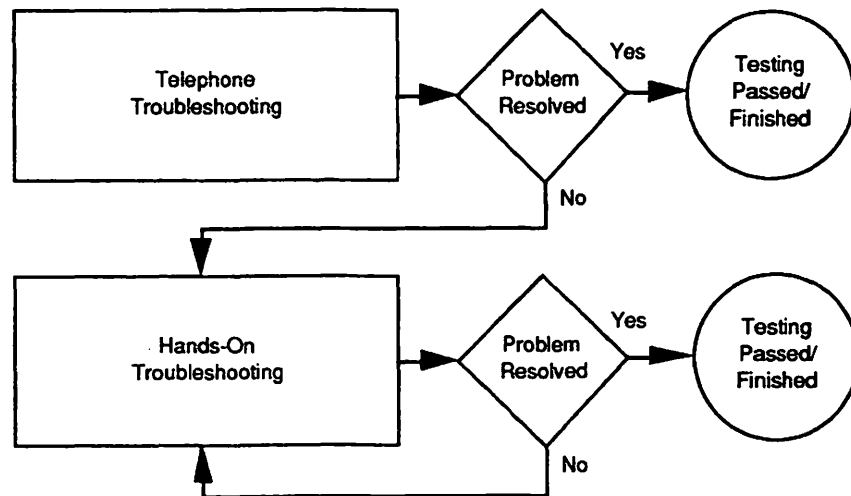
Figure 4-1
Laser printer troubleshooting process

Continue with the next section—"Telephone Troubleshooting."

Telephone Troubleshooting

This section presents a process for troubleshooting over the telephone. The troubleshooting process often begins when a customer states that his or her laser printer is not functioning properly. When troubleshooting over the telephone or when talking with a customer in person, your goal is to identify the deviation from normal operation and to take steps to quickly resolve the problem. Several variables can impact your successful achievement of this goal. First, the customer often provides a vague description of the problem. Second, the customer may not be familiar with the laser printer or the computer, and is only able to provide limited information. Third, you spend a large amount of time on the problem if you do not troubleshoot efficiently.

Determine Deviation From Normal Operation

Begin the troubleshooting process by identifying, as clearly as possible, the actual deviation from normal operation. Often a customer will call and say that his or her laser printer simply does not work. A vague symptom like this provides little useful information with which to begin troubleshooting. "Does not work" may mean anything—the printer does not power up, pages do not print, or the pages have smudge marks. You must ask, and keep asking, clarifying questions until the customer identifies a specific deviation from normal operation. Until you know the deviation from normal operation, you cannot begin to isolate the cause. Examples of questions you can ask to clarify vague symptoms are in the sections "Using the Troubleshooting Job Aid" and "Working With the Customer."

Take Troubleshooting/ Resolution Actions

Once you identify the actual deviation from normal operation, isolate the cause of the problem. You can resolve many deviations from normal operation over the telephone. The following service resources will help you isolate and resolve the cause of simple and complex problems:

- *Service Source*
- *Apple Service Guide for LaserWriter Printers*
- *Telephone Troubleshooting Job Aid*
- AppleLink
- Owner's guides

Service Source is Apple's CD-ROM-based technical service reference. *Service Source* replaced Apple's paper-based technical procedures. *Service Source* is most helpful for hands-on troubleshooting, but you should be familiar with the "Basics" and "Specifications" chapters for each laser printer so you can use the information when asking customers questions over the phone.

Apple offers a series of portable service guides, one of which covers laser printers and is called *Apple Service Guide for LaserWriter Printers.* The guide is a condensed version of *Service Source* and is more accessible when troubleshooting over the phone than *Service Source.*

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Telephone Troubleshooting

AppleLink has several libraries and bulletin boards that contain helpful service information. The information is frequently updated and includes topics that are not yet included on *Service Source* or the *Apple Service Guide for LaserWriter Printers.* Check AppleLink regularly so that you are aware of new information that will help you resolve problems quickly over the phone.

Another excellent source of information is the owner's guides. The owner's guides provide detailed information on laser printer set-up, operation, and basic troubleshooting procedures users can use when their printers malfunction. Be familiar with the guides so you can use the information when you troubleshoot over the telephone and when customers ask where they can find specific information about their laser printer. For your convenience, the owner's guides troubleshooting procedures are also included in the *Telephone Troubleshooting Job Aid.*

The *Telephone Troubleshooting Job Aid* at the end of this manual contains charts for isolating and resolving a specific deviation from normal operation. You can use the *Telephone Troubleshooting Job Aid* to practice clarifying and resolving customer problems. Locate the *Telephone Troubleshooting Job Aid* now and follow these steps to use the job aid:

1. Start by asking Question 1 at the top left corner of the flowchart—"Does a page come out of the printer? If so, what does the page look like?"

2. If the customer answers "yes" to the first question, ask the customer to describe the page. Locate the chart that shows the deviation from normal operation that matches the customer's description of the page.

    If the customer answers "no" to the first question, ask Question 2—"Switch the printer off and then on. Does a page come out?"

3. If the customer answers "yes" to the second question, identify which computer the customer has and proceed to the appropriate chart.

    If the customer answers "no" to the second question, ask Question 3—"Are any of the lights on or flashing? If so, which ones?"

4. If the customer answers "yes" to Question 3, find out which LEDs are lit and proceed to the appropriate chart.

    If the customer answers "no" to Question 3, refer to the appropriate chart.

5. Once you identify the deviation and locate the appropriate chart, perform the actions in the chart, starting with step 1.
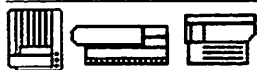
Telephone Troubleshooting

6. Compare the customer's response to the notes in the right column for each step and perform the actions in the notes (some steps in the charts do not have notes). Repeat this process until the problem is resolved, or until you decide to have the printer brought in or to go on-site.

The job aid provides examples of how you might troubleshoot specific problems over the phone. The questions you ask will depend on many variables, including customer knowledge and the customer hardware, software, and network environment. It may not be necessary to ask every question in each chart. Use the chart to assist you in developing your own logical telephone troubleshooting questions.

Verify Problem Resolution

After you isolate and resolve the cause of the problem, take time to verify proper printer operation. A good way to verify problem resolution is to have the customer re-create the actions he or she performed when the problem occurred. If the problem no longer exists, the troubleshooting-repair process is complete.

Often you will not be able to resolve the problem over the telephone. In these cases, ask the customer to bring the printer to the service center, or go-on site to continue the troubleshooting process. There are several reasons why you may not be able to resolve the problem over the telephone:

1. You must replace a module or part.
2. The problem would take too long to resolve over the telephone.
3. The problem could possibly be resolved over the telephone, but the customer is not knowledgeable enough about the computer and/or laser printer to perform the troubleshooting actions.
4. The customer does not have time to resolve the problem and would like you to provide on-site service.

The decision whether to go on-site or to have the printer brought in to your service center should be based on the nature of the problem. If you cannot resolve the problem over the telephone, and the problem is related to software, set-up, or a network, then on-site service may be required.

Continue with the next section—"Hands-on Troubleshooting."

Hands-On Troubleshooting

In the previous section, you learned the steps for telephone troubleshooting. The goal is to resolve the problem, decide if you should go on-site, or have the customer bring the printer into the service center. This section details the steps for hands-on troubleshooting. Perform hands-on troubleshooting when:

- You cannot resolve the customer's laser printer problem over the telephone.
- You rule out software, setup, user, and network problems.

Hands-on troubleshooting is similar to telephone troubleshooting in that both include the same steps:

1. Identify (telephone) or verify (hands-on) deviation from normal operation.
2. Take troubleshooting/resolution actions.
3. Verify problem resolution.

Verify Deviation From Normal Operation

Begin hands-on troubleshooting by verifying the deviation from normal operation. You may have helped the customer to identify the problem over the phone, or you may have read about the problem on a work order. In either case, you cannot be sure that the information is totally correct. If this is the first time you have seen the laser printer, you must verify that the assumed deviation from normal operation is accurate.

The best way to verify the deviation from normal operation is to set up the laser printer and try to re-create the problem. Make sure that you have all the customer's equipment. If a problem is caused by a bad cable but you don't have the customer's cable, you will not be able to re-create the problem. If you cannot re-create the problem, contact the customer and repeat customer actions until you see the symptom. Continue to discuss the problem with the customer as needed.

Take Troubleshooting/ Resolution Actions

With an accurate problem description, you are ready to take actions to further isolate and resolve the problem. Unlike telephone troubleshooting, you will perform all hands-on troubleshooting and repairs. Consult the Apple service resources below to guide you through the most effective and efficient sequence of hands-on troubleshooting. If you need to consult the Apple TAC (Technical Assistance Center), the representative will assume you have already exhausted the service references.

The following service resources that were mentioned in the "Telephone Troubleshooting" section, plus the diagnostics, will also help you with hands-on troubleshooting:

- *Service Source*
- *Apple Service Guide for LaserWriter Printers*
- AppleLink
- Laser Printer Diagnostics
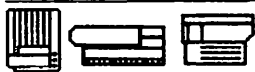
Hands-On Troubleshooting

Service Source is your primary reference for hands-on troubleshooting and is the most comprehensive service reference for Apple products. The step-by-step procedures help you effectively and efficiently isolate and resolve all laser printer problems. To use *Service Source*, locate the "Flowcharts" section for the laser printer you are repairing. Then select and use the chart that includes the problem you are trying to resolve.

The *Apple Service Guide for LaserWriter Printers* is especially helpful for on-site service calls when *Service Source* is not readily available. Additionally, AppleLink has frequent messages about new repair procedures before they are incorporated into *Service Source* or the *Apple Service Guide for LaserWriter Printers*.

Diagnostic programs are available for several Apple laser printers. The diagnostics help you to quickly and accurately isolate the cause of a print engine problem. The service resources direct you when to use a specific diagnostic. Try to become familiar with each diagnostic before you need to use it .

Verify
Problem Resolution

After you identify and replace a faulty module or part, you must always verify that the repair resolved the problem. Testing a repair is essential for several reasons. First, you may have identified a faulty module or part, but you may not have identified all the faulty modules and parts. Second, the problem may reappear when you repeat the actions that originally caused the problem. Third, some problems are intermittent and may not immediately reappear. Test the laser printer by following the steps below before you return it to the customer:

1. Set up the laser printer.
2. Run the diagnostics (if available for this printer).
3. Perform the actions that originally caused the symptom.
4. Perform basic functions.
5. Leave the printer on for 24 hours and periodically repeat steps two through four.

Testing the laser printer helps verify that the problem is completely resolved and ensures that the customer will not have to place another service call for the same problem. The extra effort you spend testing the repair will pay off in customer satisfaction and increased confidence in your service organization.

Before you continue, take time to carefully review *Service Source*, the *Apple Service Guide for LaserWriter Printers*, the various laser printer diagnostics, and the various AppleLink libraries and bulletin boards. If you do not have all of these resources, you may order them by following the instructions in the service programs information section of *Service Source*. These resources are an essential part of your troubleshooting and repair tools—the more you use them, the more effective you will be as a laser printer technician.

When you are ready, begin Exercise 1 on the following page.

Practice Exercise 1

Directions

Name and briefly describe the tasks in each major step of the telephone and hands-on troubleshooting process.

Telephone Troubleshooting:

Step 1

Step 2

Step 3

Hands-On Troubleshooting:

Step 1

Step 2

Step 3

Compare your answers with those on the next page.
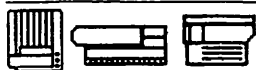
Practice Exercise 1 (Answers)

Compare your answers to Practice Exercise 1 with the answers below.

Telephone Troubleshooting:

Step 1:   *Identify deviation from normal operation.*
          Help the customer identify the actual deviation from normal operation.

Step 2:   *Take troubleshooting actions.*
          Work with the user to isolate and resolve the problem.

Step 3:   *Verify problem resolution.*
          To verify that the problem has been resolved, ask the customer to perform the actions that originally caused the problem.

Hands-On Troubleshooting:

Step 1:   *Verify deviation from normal operation.*
          Verify the deviation identified during telephone troubleshooting or on the work order.

Step 2:   *Take troubleshooting actions.*
          Use Apple service references to repair the problem.

Step 3:   *Verify problem resolution.*
          Test the printer over a period of hours to ensure the problem is gone, and that the printer performs all functions correctly.

If you missed any items, review the appropriate this section of the module and correct any incorrect answers before you continue.

When you are ready, continue with Practice Exercise 2 on the next page.

Practice Exercise 2

Directions

Answer the following questions about Apple service resources by writing your answer in the space provided.

1. Which service resource is most helpful when you troubleshoot over the telephone?

2. Which service resource is most helpful with hands-on troubleshooting?

3. Which service resource is most helpful with hands-on troubleshooting at the customer location?

4. Which resource can you use if *Service Source* and the *Apple Service Guide for LaserWriter Printers* does not provide the help you need?

5. Describe how to use the *Telephone Troubleshooting Job Aid.*

Compare your answers with those provided on the next page.
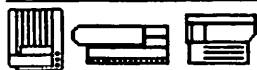
Practice Exercise 2 (Answers)

Compare your answers to Practice Exercise 2 with the answers below.

1. Which service resource is most helpful when you troubleshoot over the telephone?

   Telephone Troubleshooting Job Aid

2. Which service resource is most helpful with hands-on troubleshooting?

   Service Source

3. Which service resource is most helpful with hands-on troubleshooting at the customer location?

   Apple Service Guide for LaserWriter Printers

4. Which resource can you use if *Service Source* and the *Apple Service Guide for LaserWriter Printers* does not provide the help you need?

   AppleLink

5. Describe how to use the *Telephone Troubleshooting Job Aid.*

   1) Ask Questions 1, 2, and 3 in the flowchart until you identify the deviation from normal operation.
   2) Locate the appropriate chart in Telephone Troubleshooting Job Aid.
   3) Ask the customer the questions and/or to perform the action next to each step in the chart.
   4) Compare the customer's feedback with the notes for step 1.
   5) Follow the directions in the notes

Continue with Practice Exercise 3 on the next page.

Practice Exercise 3

Directions

Place an X in front of each customer problem statement that clearly identifies a deviation from normal operation.

___ 1. The printer doesn't print.

___ 2. The printed pages are all messed up.

___ 3. The green LED never stops flashing.

___ 4. I hear a strange grinding noise when I switch on the printer.

___ 5. The printer sounds like it is printing, but nothing prints.

___ 6. The name of my printer doesn't appear in my Chooser.

___ 7. I can't get my printer to print.

___ 8. I switched on the printer and nothing happened.

___ 9. The printer prints only on part of the page.

___ 10. The page curls.

Compare your answers with those on the next page.
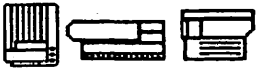
Practice Exercise 3 (Answers)

Compare your answers to Practice Exercise 3 with the answers below.

___ 1. The printer doesn't print.

___ 2. The printed pages are all messed up.

_X_ 3. The green LED never stops flashing.

_X_ 4. I hear a strange grinding noise when I switch on the printer.

___ 5. The printer sounds like it is printing, but nothing prints.

_X_ 6. The name of my printer doesn't appear in my Chooser.

___ 7. I can't get my printer to print.

___ 8. I switched on the printer and nothing happened.

_X_ 9. The printer prints only on part of the page.

_X_ 10. The page curls.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers before you continue.

**When you are ready, continue with the next section on the following page.**

Working With the Customer

Laser printer troubleshooting begins with the customer. Whether you are identifying the deviation from normal operation or isolating the cause of the problem, the customer is a valuable troubleshooting resource. When working with a customer your goal is to obtain as much helpful information as you can in a short amount of time. Customers differ in their level of computer and laser printer knowledge, so you must respond to individual abilities.

This last section of the module addresses these four topics:

1. General guidelines for working with customers.
2. Questions you can ask to clarify vague problem statements.
3. How to determine a customer's level of computer and laser printer knowledge, and how to work with the customer accordingly.
4. What to do if a customer cannot provide the necessary information or perform the requested troubleshooting actions.

General Guidelines

There are three general guidelines for working with customers. Follow these guidelines to communicate clearly and avoid misunderstandings with customers:

1. Avoid jargon or technical terms not clearly understood by the user.

   Jargon and technical terms are commonly understood by technicians, and are used in your everyday conversation. Jargon and technical terms you clearly understand may sound like a foreign language to your customers. Try to use words customers understand. This may be a difficult task at first and will require a deliberate effort on your part.

2. Clearly and slowly ask questions and give directions.

   Conversation void of jargon and technical terms still may be misunderstood by customers who can't hear you or keep up with you. Speaking clearly and slowly will help you avoid repeating questions and directions.

3. For each action you request of the customer, ask if he or she knows how to perform the task.

   If a customer does not know how to perform a task, be prepared to talk the customer through procedures. An exception might be when a customer exhibits a higher-than-normal level of knowledge about the computer and laser printer.
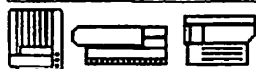
Working With the Customer

Problem Clarification

Customers will often give you a vague problem statement that provides little useful information. Your goal is to ask questions that help your customer pinpoint the real problem. The list below contains several typical customer problem statements followed by one or more questions you can ask to pinpoint the actual deviation from normal operation. Use the following key to read the list: C = customer, T = technician.

1. C: The pages look terrible.

   T: Would you describe what the page looks like?

   C: There are black stripes all over the page. (The problem)

2. C: The printer won't print.

   T: Does a page come out of the printer and, if so, what does it look like?

   C: Yes, but the page is wrong.

   T: How is the page wrong?

   C: Only part of the page prints. (The problem)

3. C: The printer doesn't work.

   T: Does a page come out of the printer and, if so, what does it look like?

   C: A page comes out, but nothing prints.

   T: Is the page blank? (The problem)

   C: Yes.

As you can see from these examples, it may take several questions to correctly identify the problem. Try to ask questions that relate to normal operation—such as "Does a page come out?" "Are any LEDs flashing?" "Did you hear the motor start?" Continue to ask questions that isolate what actually is or is not happening until you identify the real deviation.

Working With the Customer

Customer Knowledge

You need to be able to estimate a customer's computer and laser printer knowledge so that you can effectively communicate with him or her. Customers who respond in the following manner probably have an average or an above-average understanding of their computer and laser printer.

- Readily respond to your questions
- Readily respond to your requests to perform an action
- Rarely ask what you mean or ask you to define a term
- Volunteer technical information

When working with these customers, use the *Telephone Troubleshooting Job Aid* and apply the general guidelines presented earlier in this section.

Customers who respond in the following manner probably have a minimal understanding of their computer and laser printer. These customers:

- Continually ask questions or give indications of being confused, are slow to answer, and make comments like "Well, I'll see if I can" or "I think so."

- Often ask you to define terms the average user understands such as RAM, system file, hard disk, file, etc.

- Readily admit they cannot answer a question or perform an action.

When working with customers that have minimal knowledge, use the *Telephone Troubleshooting Job Aid* and the general guidelines presented earlier. You can also follow these special guidelines:

1. Use small steps to talk the customer through how to get the information you need or to perform the action you request using small steps.

    Be as graphic as you can. Physically describe what to look for and where to find it. For example, instead of asking the customer to check the toner cartridge to see if the tape is removed, you might instead direct the customer to press the cover release button on the top front of the printer above the paper tray, and then lift open the cover. You could then describe the toner cartridge as the black plastic box inside the cover, etc.

2. Ask if there is anything the customer doesn't understand or can't do. Don't request the next action until you verify that the previous action is successful. Ask if he or she feels comfortable and has the time to continue.

Not all customers fit neatly into these two categories but using these guidelines will make the time you spend with your customers more productive.

Working With the Customer

Customer Can't Assist or Can't Assist in a Timely Manner

There are times when you will be unable to obtain the information or actions you need, no matter how carefully you work with a customer. There are also times when the customer can provide some assistance, but the phone instructions take too much time. In these situations, you have three options:

1. Tactfully ask the customer if someone else in the office might be more familiar with the computer and laser printer. If so, ask the customer to have that person call you.

2. Ask the customer if his or her office has an ASC (Apple Support Coordinator) or a network administrator who might be able to solve the problem. Have that person call you.

3. Ask the customer to bring the laser printer to the service center, or go to the customer's site.

Continue with Practice Exercise 4 on the next page.

Practice Exercise 4A

Directions: Part A

This exercise has two sections: Part A and Part B. The list below contains unclear problem statements. Below each statement, list a question you can ask to clarify the problem.

1. "Yes, my document prints, but the pages are all messed up."

2. "The printer sounds like it is printing, but nothing prints."

3. "I switched my printer off and then on again. No page came out of the printer."

4. "The printer won't print. I did notice that the lights on the front of the printer are flashing."

When you are ready, continue with Part B on the next page.

Practice Exercise 4B

Directions: Part B

Indicate if each description of a customer's behavior describes a customer with an average or a minimal level of computer and laser printer knowledge. List guidelines you would follow when working with this customer.

1. The customer answers your questions and performs the actions you request, rarely asking a question or hesitating.

   ___Average Knowledge ___ Minimal Knowledge

   Guidelines you would follow:

2. The customer willingly answers your questions and begins performing actions you request, although completion seems to take longer than normal and is interrupted by questions from the customer.

   ___Average Knowledge ___ Minimal Knowledge

   Guidelines you would follow:

3. The customer willingly attempts everything you request, but finds it difficult to answer your questions and is unable to complete the tasks you request.

   ___Average Knowledge ___ Minimal Knowledge

   Guidelines you would follow:

Compare your answers with those on the next page.

Practice Exercise 4A (Answers)

Compare your answers to Practice Exercise 4A with the answers below.

1.   "Yes, my document prints, but the pages are all messed up."

      What do the pages look like?

2.   "The printer sounds like it is printing, but nothing prints."

      Does a page come out of the printer? If so, what does it look like?

3.   "I switched my printer off and then on again. No page came out of the printer."

      Are any of the lights on front of the printer flashing? If so, which ones?

4.   "The printer won't print. I did notice that the lights on the front of the printer are flashing."

      Which lights are flashing?

You may have thought of other questions. There are no perfect questions; ask questions that require the customer to give more detail about abnormal printer performance.
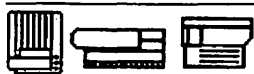
Practice Exercise 4B (Answers)

Compare your answers to Practice Exercise 4B with the answers below.

1. The customer answers your questions and performs the actions you request, rarely asking a question or hesitating.

   _X_ Average Knowledge __ Minimal Knowledge

   Guidelines you would follow:
   This customer demonstrates an average level of knowledge. When working with this customer, follow these general guidelines: avoid jargon or technical terms, speak clearly and slowly, and ask if the customer can perform each task.

2. The customer willingly answers your questions and begins performing actions you request, although completion seems to take longer than normal and is interrupted by questions from the customer.

   __ Average Knowledge _X_ Minimal Knowledge

   Guidelines you would follow:
   This customer demonstrates a minimal level of knowledge. Follow the general guidelines as well as these special guidelines: use small steps to walk the customer through getting the information you need to perform requested actions. Continually ask if the customer has questions or needs further clarification.

3. The customer willingly attempts everything you request, but finds it difficult to answer your questions and is unable to complete the tasks you request.

   __ Average Knowledge _X_ Minimal Knowledge

   Guidelines you would follow:
   This customer demonstrates minimal knowledge. Follow the general and special guidelines until you decide that the customer cannot help you resolve the problem. Tactfully ask the customer whether someone else in the office might be more familiar with the computer and laser printer and if that person can call you. Ask whether the office has an ASC or network administrator who might help. If these options prove unsuccessful, ask the customer to bring the printer to your service center or say you will go on-site.

If you missed any items, please review the appropriate section of the module and correct any incorrect answers.

When you are ready, read the directions for taking the final test on the next page.

Final Test

The final test is a series of questions on a HyperCard stack that you download from AppleLink. The questions cover the entire course and give you an opportunity to demonstrate your achievement of the course objectives. You must correctly answer 80 percent of the questions to pass the test. You may want to review the practice exercises and the "Common Symptoms/Likely Causes" lists before taking the test.

Downloading the Test

When you are ready, follow these directions to download and complete the test:

1. Connect to the AppleLink network.
2. Double-click the Apple Support/Training icon.
3. Double-click the Training bulletin board.
4. Double-click the Testing folder.
5. Double-click the Service folder.
6. Double-click **Intro to Laser Printer.**
7. Click the Download arrow once at the upper-left corner of the memo.
8. Choose the file destination on your hard drive.
9. Click **OK.** The file takes approximately eight minutes to download to your hard disk.
10. Choose **Disconnect** from the Network menu.
11. Double-click the Intro to Laser Printer test package file to expand it.
12. Double-click the Intro to Laser Printer test stack to begin the test.

If you do not pass the test, you may re-take it until you do pass. If you need help while taking the on-line test, click the Student icon to access the student services. Then click the Help button. The test help function is modeled after balloon help. When you use Help, you obtain information by simply moving the cursor around the screen.

Sending Test Results to Apple

When you finish and pass the test, an AppleLink memo automatically appears in your AppleLink Out Basket. Follow these steps to send your test results to the Apple corporate test administrator via AppleLink:

1. Connect to the AppleLink network.
2. Choose **Send Items in Out Basket** from the Mail menu.
3. Disconnect from the AppleLink network.

The test administrator is the only person who can access to your test results. When you successfully complete the final test, you have passed the Introduction to Laser Printer Service Course. Apple will mail you a permanent certificate of completion.

Congratulations on the completion of this course!

Telephone
Troubleshooting
Job Aid

Apple Service Training Development

October 1992

Telephone Troubleshooting Job Aid

The *Telephone Troubleshooting Job Aid* helps you clarify and resolve customer laser printer problems and provides examples of how you might troubleshoot specific problems over the phone. The questions you ask will depend on many variables, including customer knowledge and the customer hardware, software, and network environment. It may not be necessary to ask every question in each chart. Use the chart to assist you in developing your own logical telephone troubleshooting questions.

Follow these steps to use the job aid:

1. Begin by asking Question 1 at the top-left corner of page one—
   "Does a page come out of the printer and, if so, what does it look like?"

   If the customer answers "yes" to the first question, ask the customer to describe the page. Then locate the chart that covers the customer problem description.

   If the customer answers "no" to the first question, ask Question 2—"Switch the printer off and then on. Does a page come out?" If the customer answers "yes" to this second question, identify which computer the customer is using and proceed to the appropriate chart.

2. If the customer answers "no" to the second question, ask Question 3—"Are any of the lights on or flashing and, if so, which ones?"

   If the customer answers "yes," find out which LEDs are lit, and proceed to the appropriate chart. If the customer answers "no," refer to the appropriate chart.

3. Once you identify the deviation and locate the correct chart, ask the customer the question and/or to perform the action for step 1.

4. Compare the customer's response to the notes to the right of step 1 and follow the notes. Repeat this process until the problem is resolved or until you decide to have the printer brought in or go-on site. Some steps in the charts do not have notes in the right column.

Telephone Troubleshooting Job Aid

(Response to vague problem statement)

Any unusual noises or smells?
Go to Chart A.

Question 1
Does a page come out of the printer? If so, what does it look like?

Yes →

No ↓

Question 2
Switch the printer off and then on. Does a page come out of the printer?

Yes →

No ↓

Question 3
Are any lights on or flashing? If so, which ones?

Yes →

No ↓

Check power source.
Go to Chart B.

Are you printing from a Macintosh computer?
Go to Chart C.

Are you printing from an Apple II GS computer?
Go to Chart D.

Printer name does not appear in the Chooser.
Go to Chart E.

Ready LED flashes continuously.
Go to Chart F.

Multiple LEDs light steadily and/or flash.
Go to Chart G.

Paper jam LED lights steadily or flashes.
Go to Chart H.

Paper out LED lights steadily or flashes.
Go to Chart I.

Low-toner LED lights steadily or flashes.
Go to Chart J.

Page is blank.
Go to Chart K.

Takes too long to print.
Go to Chart L.

Unwanted lines or stripes appear.
Go to Chart M.

Prints off-center or images are out of place.
Go to Chart N.

Prints part of the page.
Go to Chart O.

Stains appear on page.
Go to Chart P.

Image is smudged.
Go to Chart Q.

Image is too dark or the page is solid black.
Go to Chart R.

Image is too light.
Go to Chart S.

Page curls.
Go to Chart T.

Images are wavy or distorted.
Go to Chart U.

Telephone Troubleshooting Job Aid

Chart A - Unusual Noises and/or Smells	Notes
1. Switch off the printer.	
2. Did you receive error messages?	
3. What does the printer sound or smell like?	• If it is an abnormal sound or any kind of smell, continue.
4. What were you doing when the problem occurred?	• Try to identify possible faulty user operation. Continue.
5. Open the cover. Do you see jammed paper or other foreign matter?	• If yes, remove, then continue. • If no, continue.
6. Remove the paper cassette. Do you see jammed paper or other foreign matter?	• If yes, remove and then replace cassette and continue. • If no, skip to Step 8.
7. Are you using 16–20 lb. bond typewriter or photocopy paper in the paper cassette, or 16–36 lb. bond typewriter or photocopy paper for manual feed?	• If yes, continue. • If no, have the user replace the current paper with the correct paper. Continue.
8. Switch on the printer. Does it make the same noise and/or smell?	• If yes, switch off the printer and skip to Step 11. • If no, continue.
9. Does the printer generate a user test page?	• If yes, continue. • If no, skip to Step 11.
10. Try printing from your computer. Print OK?	• If yes, the printer is fixed. • If no, go to Question 1.
11. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart B - Check Power Source	Notes
1. Did you receive an error message?	
2. Is the printer plugged in?	•If yes, continue. •If no, plug in and switch on the printer. If the LEDs light, skip to Step 5. If the LEDs do not light, continue.
3. Is the power source OK?	•If yes, skip to Step 5. •If not sure, continue. •If no, have the user talk to building maintenance.
4. Have the user connect the printer's power cord to another power source and then switch on the printer. Do the LEDs light?	(If the user is unable to find another power source, have the user contact building maintenance.) •If yes, skip to Step 6. •If no, continue.
5. Check and do the following: Is the cover open? If so, close the cover. Is the toner cartridge installed? If not, install the toner cartridge. If the printer is a Personal LaserWriter, pull down the paper tray, pull down the Fuser Assembly access door and close the door again (resets the access door switch). Do the LEDs light?	•If yes, continue. •If no, skip to Step 8.
6. Is a User Test Page generated?	•If yes, continue. •If no, skip to Step 8.
7. Try printing from your computer. Print OK?	•If yes, the problem is fixed. •If no, go to Question 1.
8. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart C - Cannot Print From Macintosh Computer	Notes
1. Did you receive an error message?	
2. Is the printer selected in the Chooser?	• If yes, continue. • If no, select the printer and try printing. If it prints, the printer is fixed. (If the printer's name does not appear, refer to Chart E.)
3. Is the printer/network cable connected to the printer port on the computer and to the printer?	• If yes, continue. • If no, tell the user to consult the owner's manual or network administrator to correctly connect the cable, and try printing. If the printer prints, it is fixed.
4. Are the switch settings correct?	(If the printer is on a network, have the customer consult with the network administrator.) • If yes, continue. • If no, correctly set the switches and try printing. If the printer prints, it is fixed.
5. Return to the Desktop, pull down the File menu, and choose Print Window. Print OK?	• If yes, the computer and printer work fine. (The problem is application or file related. Direct the customer to the software documentation or to the software manufacturer.) • If no, continue.
6. Are you on a network?	• If yes, continue. • If no, go to Step 8.
7. Can anyone else on the network print to the same printer?	• If yes, continue. • If no, it is a network problem—talk to the network administrator.
8. Reinstall the system software. Print OK?	• If yes, the problem is fixed. • If no, continue.
9. Go on-site or have the user bring the printer in.	

4

Telephone Troubleshooting Job Aid

Chart D - Cannot Print From An Apple IIGS	Notes
1. Did you receive an error message?	
2. Have you installed the LaserWriter Update on your startup disk?	• If yes, continue. • If no, refer the user to the printer owner's guide for directions on connecting to an Apple II. After carefully completing each step, try printing.
3. Is your printer connected to the printer or the modem port?	• If the printer port, continue. • If the modem port, skip to Step 5.
4. Is Slot 1 set to your card?	• If yes, skip to Step 6. • If no, reset and try printing. If it prints, the problem is fixed. If it does not print, skip to Step 6.
5. Is Slot 2 set to your card?	• If yes, continue. • If no, reset and try printing. If it prints, the problem is fixed. If it does not print, continue.
6. Does your Apple IIGS have ROM version 1.01?	• If yes, continue. • If no, skip to Step 8.
7. Is Slot 7 set to AppleTalk?	• If yes, continue. • If no, reset and try printing. If it prints, the problem is fixed. If it does not print, continue.
8. Are you using an application that prints to the printer as if it were an ImageWriter printer?	• If yes, continue. • If no, skip to Step 10.
9. Is the ImageWriter Emulator installed?	• If yes, continue. • If no, have the user refer to the printer owner's guide for directions on installing the emulator. (The emulator must be reinstalled each time the printer is switched off and on.) Try printing. If it prints, the problem is fixed. If it does not, continue.
10. Do you have a LocalTalk connector box connected to both the computer and the printer?	• If no, have the user correctly connect the printer to the computer and try printing.
11. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart E - Printer's Name Does Not Appear in the Chooser	Notes
1. Did you receive an error message?	
2. Are you are on a network?	• If yes, continue. • If no, skip to Step 7.
3. Is anyone else having a problem printing to this printer?	• If yes, the problem is more than likely with the network—refer the user to the network administrator. • If no, continue.
4. Did you ask the network administrator for help?	• If yes, what corrective actions were taken? Skip steps already completed by the user. • If no, continue.
5. Does your network have zones?	• If yes, continue. • If no, skip to Step 7.
6. Have you selected the correct zone?	• If yes, continue. • If no, select the correct zone and see if the printer's name appears in the Chooser. (The printer appears only if you select the correct zone.) If the name appears, the problem is fixed. If it does not, continue.
7. What printer model are you printing to, and is the correct driver selected?	(If the correct driver—and/or prep file, if required—is not installed in the system folder, have the user install the printing system software. Then continue.) • If yes, skip to Step 9. • If no, continue.
8. Select the correct driver. Does the printer name appear?	• If yes, skip to Step 12. • If no, continue.

Continue on the next page.

Telephone Troubleshooting Job Aid

9. Is there more than one System Folder on the startup disk or on another disk connected to the computer?	•If yes, trash the other System files, restart the computer, open the chooser, select the correct driver, and see if the printer name appears. •If no, continue.
10. If the printer is on a network (single or multiuser), is AppleTalk active?	•If yes, continue. •If no, click AppleTalk Active, then click on the correct driver and see if the printer name appears in the Chooser. If the name appears, the problem is fixed. If it does not, continue.
11. Is the printer plugged in, switched on, and the switch setting correct?	•If yes, continue. •If no, plug in and switch on the printer. If on a network, have the customer consult the network administrator before resetting the switches. See if the printer name appears in the Chooser. If it appears, the problem is fixed. If it does not, continue.
12. Generate a user test page (consult the network administrator first, if on a network). Print OK?	(If the user test page is switched off, have the customer turn it on and generate a user test page.) •If yes, continue. •If no, go to Question 1.
13. Check the user test page. Did anyone rename the printer? Does the printer's new name appear in the Chooser?	•If yes, use the name to select the printer. Skip to Step 16. •If no, continue.
14. Is the printer or network cable connected to the printer port on your computer?	•If yes, continue. •If no, correctly connect the cable, select the correct driver, and see if the printer name appears. Continue.
15. Is the printer or network cable connected to the printer?	•If yes, continue. •If no, correctly connect the cable, select the correct driver, and see if the printer name appears. If it does, continue. If it does not, skip to Step 17.
16. Try printing from your computer. Print OK?	•If yes, the problem is fixed. •If no, go to Question 2.
17. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart F - Ready LED Flashes Continuously	Notes
1. Did you receive an error message?	
2. Wait three minutes. Does the Ready LED glow steadily?	• If yes, the problem is fixed. • If no, continue.
3. Are you printing using manual feed?	• If yes, continue. • If no, skip to Step 5.
4. Insert paper and wait for the page to print. Does the Ready LED eventually glow steadily after printing?	• If yes, the problem is fixed. • If no, continue.
5. Switch printer off then on again. Does the Ready LED light steadily?	• If yes, the problem is fixed. • If no, continue.
6. Go-on site or have the user bring the printer in.	

Chart G - Multiple LEDs Glow and/or Flash	Notes
1. Did you receive an error message?	
2. Wait a few minutes. Printer may be executing the self-test and the user test page. Is a single LED flashing now?	• If yes, continue. • If no, skip to Step 4.
3. Which LED is lit or flashing?	• If a single LED glows or flashes, refer to the appropriate chart.
4. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart H - Paper Jam LED Lights Steadily or Flashes	Notes
1. Did you receive an error message?	
2. Are any covers open?	• If yes, continue. • If no, skip to Step 4.
3. Close the covers. Does the Paper Jam LED go off?	• If yes, skip to Step 7. • If no, continue.
4. Open the cover, remove jammed paper, and close the cover. Does the paper jam LED go off?	• If yes, skip to Step 7. • If no, continue.
5. Remove the paper cassette, remove jammed paper, and fully reinsert the cassette. Does the paper jam LED go off?	• If yes, skip to Step 7. • If no, continue.
6. Does your printer have a fuser cleaner pad? If yes, take out the cleaning pad (careful; it may be hot) and look for and remove paper jammed in the fuser. Does the paper jam LED go off?	• If yes, continue. • If no, skip to Step 9.
7. Generate a user test page. Print OK?	• If yes, continue. • If no, skip to Step 9.
8. Try printing from your computer. Print OK?	• If yes, the problem is fixed. • If no, go to Question 2.
9. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart I - Paper-Out LED Lights Steadily or Flashes	Notes
1. Did you receive an error message?	
2. Is the paper cassette tray empty? Fill the tray. Does the paper-out LED go off?	• If yes, skip to step 4. • If no, continue.
3. Is the paper cassette fully inserted? Insert cassette. Is paper-out LED off?	• If yes, continue. • If no, skip to step 5.
4. Generate a user test page. Print OK?	(Is the user test page switched off? If it is off, have the user switch it on and generate a user test page.) • If yes, the problem is fixed. • If no, continue.
5. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart J - Low-Toner LED Lights Steadily or Flashes	Notes
1. Did you receive an error message?	
2. Is the cover open? Close the cover. Does the low-toner LED go off?	•If yes, skip to step 6. •If no, continue.
3. Is the toner cartridge installed? Install. Does low-toner LED go off?	•If yes, skip to step 6. •If no, continue.
4. Remove the toner cartridge and gently rock it back and forth about 90 degrees. Reinstall toner cartridge. Does low-toner LED go off?	•If yes, skip to step 6. •If no, continue.
5. Replace the toner cartridge. Does the low-toner LED go off?	(Remind the user to follow the directions in the new toner cartridge.) •If yes, continue. •If no, skip to Step 8.
6. Generate a user test page. Print OK?	(Is the user test page switched off? If it is off, have the user turn it on and generate a user test page.) •If yes, continue. •If no, go to Question 2.
7. Try printing from the computer. Print OK?	•If yes, the problem is fixed. •If no, go to Question 2.
8. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart K - Page Is Blank	Notes
1. Did you receive an error message?	
2. Has the toner cartridge been replaced recently?	• If yes, continue. • If no, replace and skip to Step 4.
3. Was the sealing tape removed from the toner cartridge?	• If yes, continue. • If no, remove the tape and continue.
4. Generate a user test page. Print OK?	• If yes, continue. • If no, skip to Step 6.
5. Try printing from your computer. Print OK?	• If yes, the problem is fixed. • If no, go to Question 2.
6. Go-on site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart L - Takes Too Long to Print	Notes
1. Did you receive an error a message or message from Print Monitor?	
2. Are you on a network?	• If yes, continue • If no, skip to Step 5.
3. Is anyone else having a problem printing to this printer?	• If yes, the problem is more than likely a network problem. Refer user to the network administrator. • If no, continue.
4. Did you ask the network administrator for help?	• If yes, avoid taking corrective actionsthat the administration may have already taken. • If no, continue.
5. Does it eventually print?	• If yes, continue. • If no, go to Question 2.
6. Is the print quality OK?	• If yes, continue. • If no, go to Question 1.
7. Are you printing a large file or a file with high-density graphics?	(Large files and/or high-density graphics will often take longer to print.) • If yes, continue. • If no, continue.
8. Return to the Desktop, open the File menu, and click Print Window. Print OK?	• If yes, the user's application or file may be slowing the printing process. • If no, continue.
9. Is the printer on a print spooler?	• If yes, the spooler may be causing the delay. Have the user talk to the network administrator. • If no, continue.
10. Are you using system software 6.0 or earlier?	• If yes, continue. • If no, skip to Step 12.

Continue on the next page.

Telephone Troubleshooting Job Aid

11. Turn off MultiFinder. Print OK?	• If yes, the problem is fixed. • If no, continue.
12. Are you using manual feed?	• If yes, manual feed takes longer to print each page. • If no, continue.
13. Does your printer have minimum RAM?	• If yes, more RAM may speed up printing of large files and/or high-density graphics. • If no, continue.
14. Go on-site or have the user bring the printer in.	

Telephone Troubleshooting Job Aid

Chart M - Unwanted Lines or Stripes Appear	Notes
1. Redistribute the toner in the cartridge (rock cartridge back and forth 90 degrees). Print OK?	•If yes, the problem is fixed. •If no, continue.
2. Replace the toner cartridge. Print OK?	•If yes, the problem is fixed. •If no, continue.
3. Are you printing bitmapped images?	•If yes, continue. •If no, skip to Step 5.
4. Open Page Setup, select Options and then select Precision Bitmap Alignment. Switch off Faster Bitmap Printing and Graphics Smoothing. Print OK?	•If yes, the problem is fixed. •If no, continue.
5. Are you using a serial cable to connect the printer to your computer?	•If yes, continue. •If no, skip to Step 7.
6. Check the communications settings to make sure they are set properly. Print OK?	•If yes, the problem is fixed. •If no, continue.
7. Go on-site or have the user bring the printer in.	

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Chart N - Printing Is Off Center or Images Are out of Place	Notes
1. Are you using bond typewriter or photocopy paper? Use 16–20 lb. for automatic feed and 16–36 lb. for manual feed.	• If yes, skip to Step 3. • If no, continue.
2. Replace the paper with the correct type. Print OK?	• If yes, problem is fixed. • If no, continue.
3. Check the paper cassette. Is it too full?	• If yes, continue. • If no, skip to Step 5.
4. Refill paper cassette to the proper level. Print OK?	• If yes, problem is fixed. • If no, continue.
5. Check the margins in your document. Are they incorrect?	• If yes, reset the margins and try printing. • If no, continue.
6. Go on-site or have the user bring the printer in.	

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Chart O - Printer Prints Only Part of the Page	Notes
1. Open Page Setup. Is the appropriate size of paper selected?	•If yes, skip to Step 3. •If no, continue.
2. Select Larger Print Area. Print OK?	•If yes, problem is fixed. •If no, continue.
3. Go on-site or have the user bring the printer in.	

Chart P - Stains Appear on the Printed Page	Notes
1. Clean the printer as you would when installing a new toner cartridge. Print OK?	(Refer user to the maintenance section of the owner's guide or to the installation directions for each new toner cartridge.) •If yes, the problem is fixed. •If no, continue.
2. Go on-site or have the user bring the printer in.	

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Chart Q - Image Is Smudged	Notes
1. Are you using bond typewriter or photocopy paper? Are you using 16–20 lb. for automatic feed and 16–36 lb. for manual feed?	• If yes, skip to Step 3. • If no, continue.
2. Replace paper with the correct type. Print OK?	• If yes, the problem is fixed. • If no, skip to Step 4.
3. Replace the paper. Print OK?	• If yes, the problem is fixed. • If no, continue.
4. Is the environment where the printer is located correct? Is the temperature between 50 and 90 degrees F, and humidity between 20 and 80 percent?	• If yes, skip to Step 6. • If no, continue.
5. Move the printer to a better location. Print OK?	• If yes, the problem is fixed. • If no, continue.
6. Go on-site or have the user bring the printer in.	

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Chart R - Image Is Too Dark or the Page Is Solid Black	Notes
1. Reset the print density control to a lighter setting. Print OK?	•If yes, the problem is fixed. •If no, continue.
2. Replace the toner cartridge. Print OK?	•If yes, the problem is fixed. •If no, continue.
3. Go on-site or have the user bring the printer in.	

Chart S - Image Is Too Light	Notes
1. Check the low-toner LED. Is it on?	•If yes, continue . •If no, skip to Step 3.
2. Replace the toner cartridge. Print OK?	•If yes, problem is fixed. •If no, continue.
3. Reset the print density control to a darker setting. Print OK?	•If yes, problem is fixed. •If no, continue.
4. Are you using bond typewriter or photocopy paper, 16–20 lb. for automatic feed and 16–36 lb. for manual feed?	•If yes, skip to Step 6. •If no, continue.
5. Replace the paper with the correct type. Print OK?	•If yes, the problem is fixed. •If no, continue.
6. Go on-site or have the user bring the printer in.	

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Chart T - Page Curls	Notes
1. Are you using bond typewriter or photocopy paper, 16–20 lb. for automatic feed and 16–36 lb. for manual feed?	• If yes, skip to Step 3. • If no, continue.
2. Replace the paper with the correct type. Print OK?	• If yes, the problem is fixed. • If no, skip to Step 4.
3. Replace the paper. Print OK?	• If yes, the problem is fixed. • If no, continue.
4. Go on-site or have the user bring the printer in.	

Chart U - Images Are Wavy or Distorted	Notes
1. Go on-site or have the user bring the printer in.	