



LaserWriter Pro 600/630  
Service Course

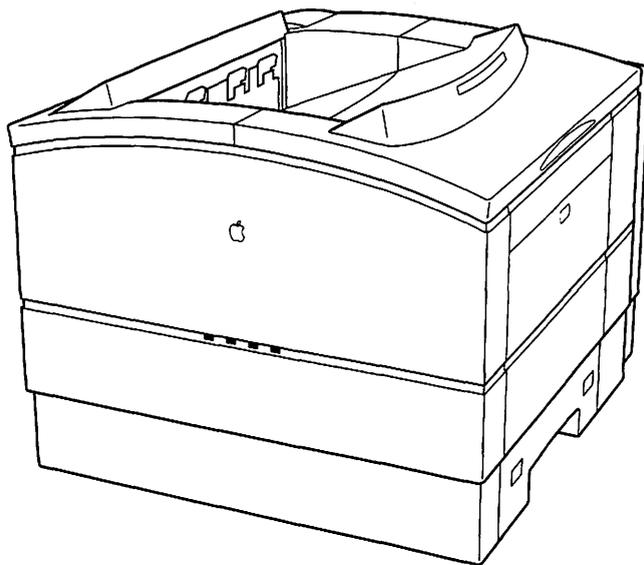
# Service Training



Version 1.1

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# LaserWriter Pro 600/630 Service Course



Apple Service Training Development

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# Getting Started

Welcome to the *LaserWriter Pro 600/630 Service Course*!

This course helps you learn to service the Apple® LaserWriter® Pro 600/630 family of printers. To provide quality customer service, you must know how to identify printer components and functions; take apart and reassemble the printer; and diagnose problems. The course covers these topics in three main modules:

- LaserWriter Pro Parts and Functions
- LaserWriter Pro Take-Apart
- LaserWriter Pro Troubleshooting

Each module includes activities that help you achieve the module objectives. You should have a more-experienced colleague or manager available to help you as needed. To get the most from this course, follow these five steps:

1. Begin with the first module, “LaserWriter Pro Parts and Functions.”
2. Read through the module and complete all the module activities. You’ll be asked to use other resources, such as *Apple Service Source*, and to perform various service procedures throughout the module.
3. Complete the module test (modules 1 and 3 only) after you finish the module activities.
4. Ask your manager or colleague to check your work.
5. Repeat steps 2–4 as applicable for each remaining module. (The second module “LaserWriter Pro Take Apart” does not have a separate module test. However, you should meet the module objectives by correctly and efficiently taking apart and reassembling the printer.)

**When you are ready, read the “Overview” section of “LaserWriter Pro Parts and Functions.”**



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# Module 1—Parts and Functions

## Overview

This module identifies LaserWriter Pro printer components and describes their functions.

**Objectives**

When you finish this module, you should be able to

- Locate the components and major parts of the LaserWriter Pro
- Match a list of LaserWriter Pro components with their functions

**Required Materials**

This module requires the following materials and equipment:

- LaserWriter Pro printer with the covers and panels, I/O shield and I/O board, and paper pickup block removed
- *LaserWriter Pro Service Training* videotape
- *Apple Service Source* CD ROM (February 1996 or later)

**Module Organization**

This module consists of the following sections:

- Overview
- Print Cycle Initiation
- Practice Exercise 1
- Practice Exercise 2
- Print Cycle Completion
- Practice Exercise 3
- Practice Exercise 4
- Module Test

This Overview provides basic information about this module and about the LaserWriter Pro printer. The “Print Cycle Initiation” and “Print Cycle Completion” sections describe the functions of the printer components that operate during the print initiation phase and the print completion phase.

The “Practice Exercise” sections help you hone your knowledge of printer components and functions in preparation for the module test.

The “Module Test” section explains how to proceed with the test. You should be able to pass the module test with 80 percent accuracy.

# Overview

## Basic Features

The Apple LaserWriter Pro 600 and LaserWriter 630 are high-quality laser printers that print up to eight pages per minute at 600 dpi. The LaserWriter Pro 600 and 630 printers are identical except for their I/O boards. The printers support a wide range of media sizes and types including paper, envelopes, adhesive labels, and transparency film. Two optional user-installed accessories are available—a lower cassette and feeder, which holds an additional 500 sheets of paper, and an envelope feeder, which provides high-volume envelope printing. Features and specifications of the printers are included in the "Specifications" chapter of the LaserWriter Pro 600/630 manual on *Apple Service Source*.

## Printer Orientation

Figure 1-1 orients you to the LaserWriter Pro printer.

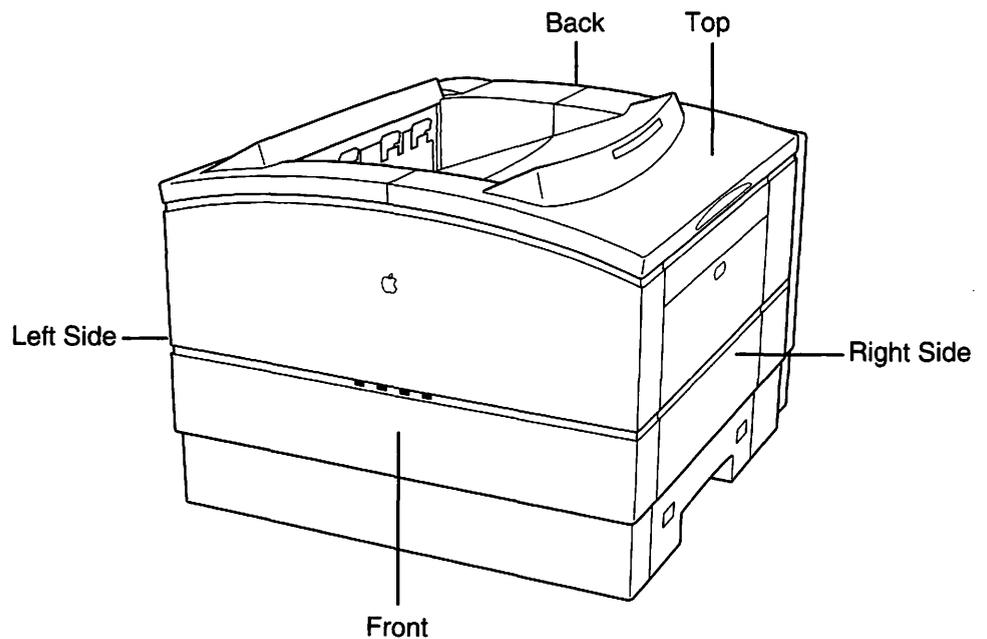


Figure 1-1  
The LaserWriter Pro Orientation

# Overview

## Paper Path

This module presents LaserWriter Pro printer components generally in the sequence in which they function during a print cycle. In a print cycle, paper is picked up and moved through the printer following an "s-shaped" path. Figure 1-2 illustrates the paper path of a LaserWriter Pro with optional envelope and sheet feeders installed.

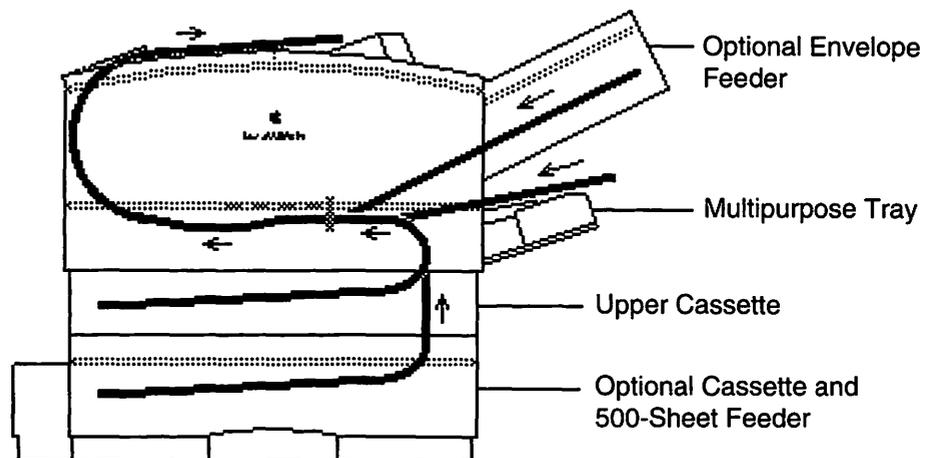


Figure 1-2  
The LaserWriter Pro Paper Path

**Note:** Although most LaserWriter Pro printer components are similar in function to those in other laser printers you have trained on and serviced, many components differ in location and physical design. Figures presented in this module are used only to identify the location of these components. Detailed illustrations of each component and the overall operation of the printer are presented in the "Basics," "Specifications," and "Parts" chapters of the LaserWriter Pro 600/630 manual on *Apple Service Source*. Carefully review these chapters before you begin the next section of the module.

**When you are ready, continue with "Print Cycle Initiation" on the next page.**

# Print Cycle Initiation

Print initiation begins when the printer is switched on and ends when a sheet of paper is picked up and moved toward the toner cartridge. This section discusses the locations and functions of the components that operate during the print initiation phase of the print cycle.

## Components

The following components function during the initiation phase of the print cycle:

- Power supply
- I/O shield and I/O board
- DC controller board
- Main motor
- Paper pickup block
- Pickup controller board
- Top cover interlock switch SW601 and actuator
- Multipurpose tray assembly
- Service test print switch
- Envelope Feeder Cable
- Upper cassette
- Pickup block motor
- Multipurpose pickup roller
- Pickup sensor board
- Multipurpose pickup roller solenoid
- Multipurpose paper-end sensor PS701 and sensor arm
- Registration paper sensor PS602 and sensor arm
- Cassette pickup roller
- Cassette paper sensor PS601 and sensor arm
- Upper cassette size sensing switches SW603, SW604, and SW605
- Cassette pickup roller solenoid

## Functions

This section summarizes the functions of the print cycle initiation components.

**Important:** Read this section in conjunction with viewing “Part 1, Parts and Functions—Print Cycle Initiation” of the *LaserWriter Pro Service Training* videotape. Part 1 identifies the above components and their functions. Stop, rewind, or restart the tape any time you wish to review a segment of the tape. Each part of the tape is numbered in the upper right corner of the screen.

- The power supply (see Figure 1-3) houses the AC power receptacle and the printer on/off switch. The power supply provides AC power to the fuser assembly and DC power to the DC controller board. The fan operates when the printer is switched on.
- The I/O shield (see Figure 1-3) secures the I/O board to the printer. The I/O board controls communications between the printer and external devices, and prints the user test page. The I/O board contains the cable connectors, ROM, RAM, and the printer’s microprocessor.

## Print Cycle Initiation

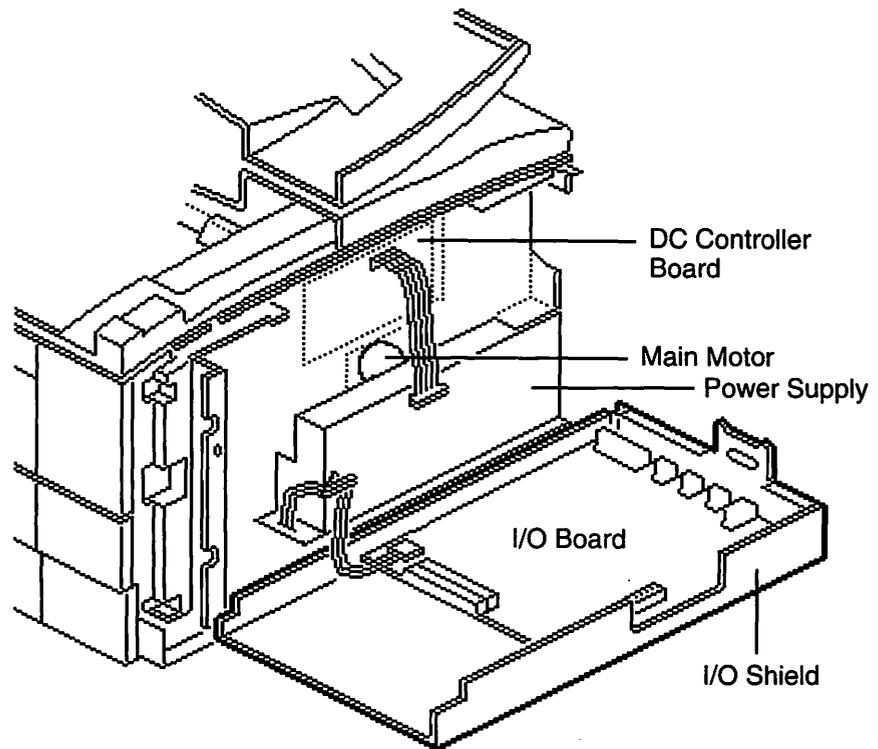


Figure 1-3  
LaserWriter Pro Components Back View

- The DC controller board (see Figure 1-3) is the interface between the I/O board and the print engine. The DC controller board controls the printer, distributes DC power, and prints the service test page. This board also controls the pickup controller board, discussed later in this section. Immediately after you switch on the printer, the DC controller board detects whether the ready states are present, and if they are, signals the I/O controller to print the user test page.
- The main motor (see Figure 1-3) runs the drive assembly. The drive assembly is discussed in the "Print Cycle Completion" section.

## Print Cycle Initiation

- The paper pickup block (see Figure 1-4) picks up and feeds paper toward the toner cartridge. The print cycle initiation components discussed below are part of the paper pickup block.

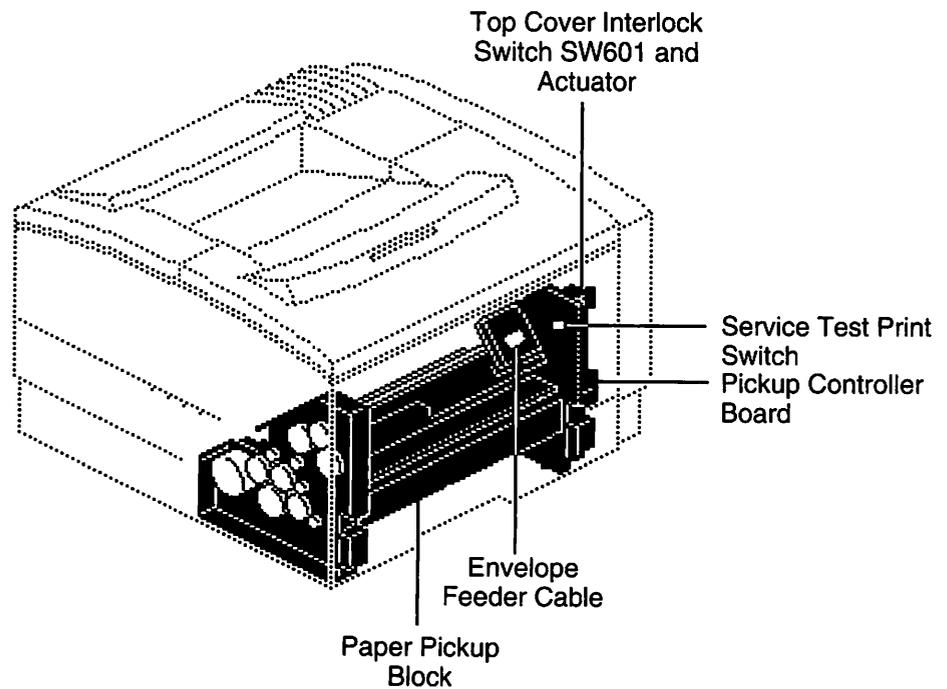


Figure 1-4  
The Paper Pickup Block (Right Side View)

- The pickup controller board (see Figure 1-4) controls the paper pickup block and the 500-sheet feeder and envelope feeder controller boards when these options are installed.
- The top cover interlock actuator (see Figure 1-4) trips the top cover interlock switch SW601 when the top cover is open, signaling the DC controller that the cover is open.

## Print Cycle Initiation

- The multipurpose tray assembly (see Figure 1-5) holds 100 sheets of paper for manual or automatic feed.

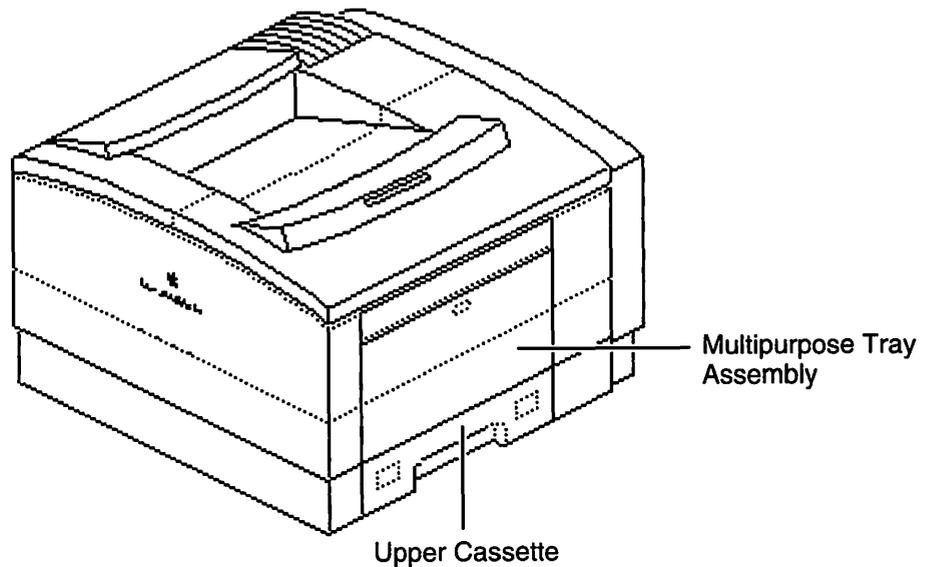


Figure 1-5  
The Standard Paper Feed

- The service test print switch (see Figure 1-4) executes a service test print when activated.
- The envelope feeder cable (see Figure 1-4) connects the envelope feeder controller board to the pickup controller board.
- The upper cassette (see Figure 1-5) holds 250 sheets of paper for automatic feed.

## Print Cycle Initiation

- The pickup block motor (see Figure 1-6) drives the cassette and multipurpose pickup rollers on the paper pickup block.

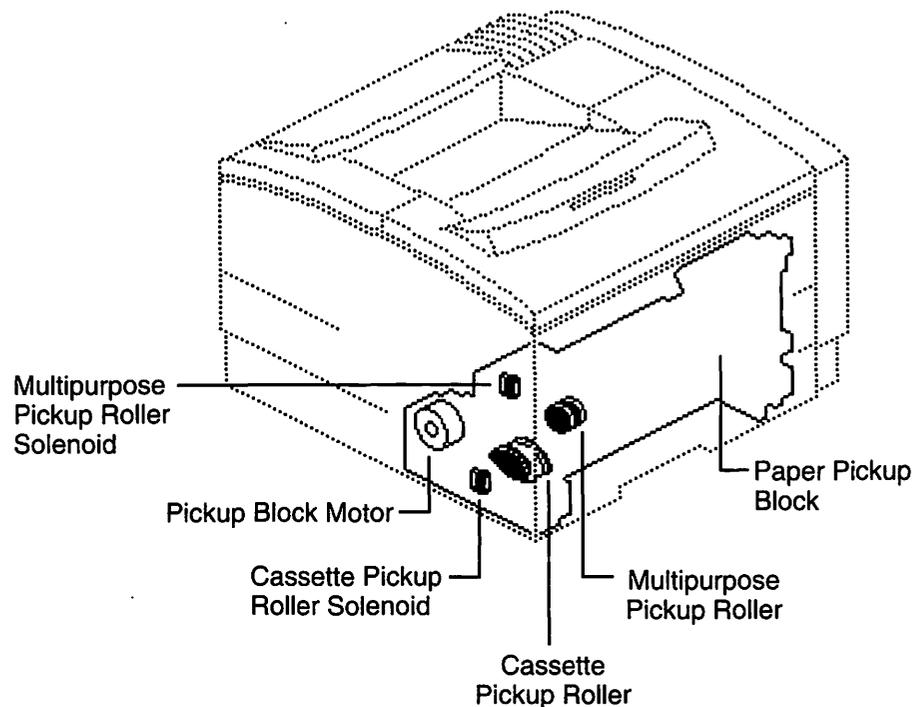
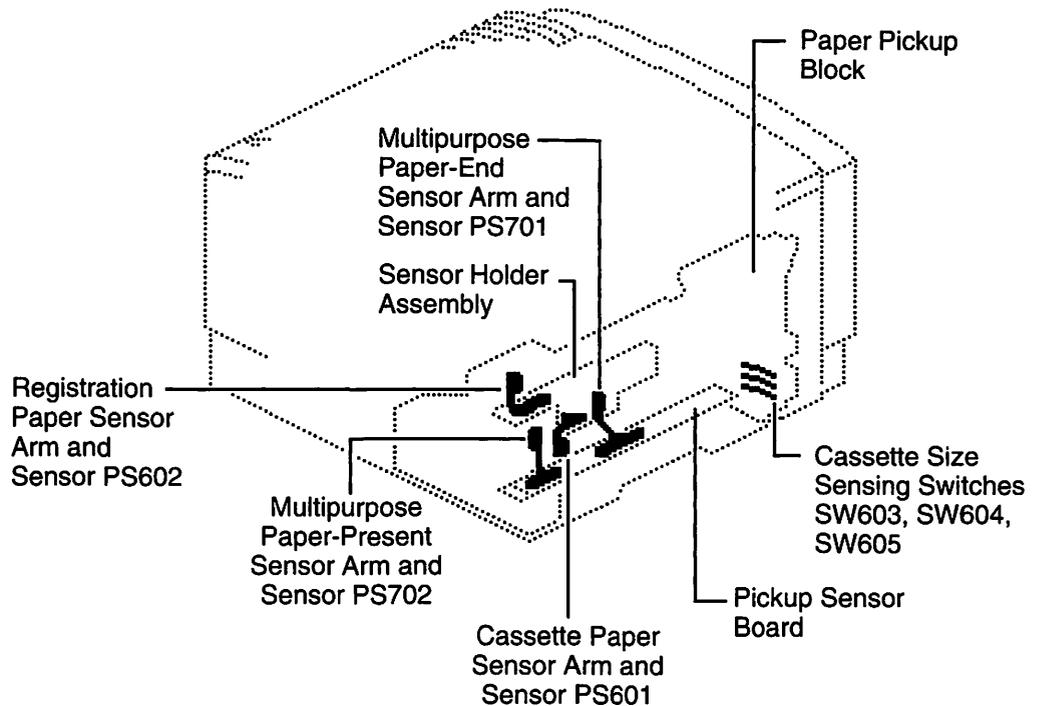


Figure 1-6  
Paper Pickup Rollers and Solenoids

- The multipurpose pickup roller (see Figure 1-6) feeds paper from the multipurpose tray when it is selected as the source of paper.
- The multipurpose paper-present sensor PS702 and sensor arm (see Figure 1-7) detect whether paper is in the multipurpose tray.
- The pickup sensor board (see Figure 1-7) contains the paper-present and the paper-end sensors. The pickup sensor board is located inside the paper pickup block above the upper cassette.
- The multipurpose pickup roller solenoid (see Figure 1-6) controls the multipurpose pickup roller.
- The multipurpose paper-end sensor PS701 and sensor arm (see Figure 1-7) detect the length of the paper picked up from the multipurpose tray.

# Print Cycle Initiation



**Figure 1-7**  
Paper Pickup Sensors

- The registration paper sensor PS602 and sensor arm (see Figure 1-7), when activated, cause the paper to be held until the the top edge of the paper is synchronized with the photosensitive drum.
- The cassette pickup roller (see Figure 1-6) feeds paper from the upper cassette when it is selected as the source of paper.
- The cassette paper sensor PS601 and sensor arm (see Figure 1-7) detect whether paper is in the upper cassette. Sensors PS601 and PS602 reside on the sensor holder assembly (see Figure 1-7).
- The cassette pickup roller solenoid (see Figure 1-6) controls the cassette pickup roller.
- The cassette size sensing switches (see Figure 1-7) detect the size of the upper cassette installed in the printer.

**Continue with “Practice Exercise 1.”**

## Practice Exercise 1

In this exercise you can practice locating LaserWriter Pro printer components that function during the initiation phase of the print cycle.

**Warning:** The LaserWriter Pro contains potentially dangerous voltage. To eliminate the risk of injury due to shock, make sure that the power cable is disconnected from the printer before beginning this exercise.

Using appropriate reference documents, practice locating each component from the list until you can locate all components from memory. You may want to ask a colleague to name each item in the list so you can point to it.

- Power supply
- I/O shield and I/O board
- DC controller board
- Main motor
- Paper pickup block
- Pickup controller board
- Top cover interlock switch SW601
- Multipurpose tray assembly
- Service test page switch
- Envelope feeder cable
- Upper cassette
- Pickup block motor
- Multipurpose pickup roller
- Multipurpose paper-present sensor PS702 and sensor arm
- Pickup sensor board
- Multipurpose pickup roller solenoid
- Multipurpose paper-end sensor PS701 and sensor arm
- Registration paper sensor PS602 and sensor arm
- Cassette pickup roller
- Cassette paper sensor PS601 and sensor arm
- Upper cassette size sensing switches SW603, SW604, and SW605
- Cassette pickup roller solenoid

If you were unable to locate some components, review the videotape or the “Parts” chapter in the LaserWriter Pro 600/630 manual on *Apple Service Source*.

**When you are ready, begin “Practice Exercise 2.”**

## Practice Exercise 2

Match the components with their functions by writing the letter of the function in the space next to the appropriate component.

- |                                                            |                                                                                                          |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| ___ Power supply                                           | A. When activated, signals the DC controller that the top cover is open.                                 |
| ___ I/O board                                              | B. Contains the paper-present and paper-end sensors.                                                     |
| ___ DC controller board                                    | C. Distributes DC power to the printer.                                                                  |
| ___ Main motor                                             | D. Drives the pickup rollers.                                                                            |
| ___ Paper pickup block                                     | E. Provides AC and DC power to the printer.                                                              |
| ___ Pickup controller board                                | F. Causes paper to be fed into the printer from the upper cassette.                                      |
| ___ Top cover interlock switch SW601                       | G. Controls the paper pickup block.                                                                      |
| ___ Multipurpose pickup roller and solenoid                | H. Runs the drive assembly.                                                                              |
| ___ Multipurpose paper-present sensor PS702 and sensor arm | I. Detects whether there is paper in the upper cassette.                                                 |
| ___ Pickup sensor board                                    | J. Controls communications between the printer and external devices, and prints the user test page.      |
| ___ Multipurpose paper-end sensor PS701 and sensor arm     | K. Detects whether paper is in the multipurpose tray.                                                    |
| ___ Registration paper sensor PS602 and sensor arm         | L. Causes paper to be fed into the printer from the multipurpose tray.                                   |
| ___ Cassette paper sensor PS601 and sensor arm             | M. Detects length of paper fed into the printer from the multipurpose tray.                              |
| ___ Cassette pickup roller and solenoid                    | N. Synchronizes edge of paper with the photosensitive drum.                                              |
| ___ Pickup block motor                                     | O. Picks up paper from the upper cassette and multipurpose tray and feeds it toward the toner cartridge. |

**When you are finished, compare your answers to those in the answer section that follows.**

## Practice Exercise 2 (Answers)

Compare your answers in "Practice Exercise 2" with those given below.

- E Power supply
- J I/O board
- C DC controller board
- H Main motor
- O Paper pickup block
- G Pickup controller board
- A Top cover interlock switch SW601
- L Multipurpose pickup roller and solenoid
- K Multipurpose paper-present sensor PS702 and sensor arm
- B Pickup sensor board
- M Multipurpose paper-end sensor PS701 and sensor arm
- N Registration paper sensor PS602 and sensor arm
- I Cassette paper sensor PS601 and sensor arm
- F Cassette pickup roller and solenoid
- D Pickup block motor

If you missed more than three items, review this section before continuing.

**When you are ready, continue with "Print Cycle Completion."**

# Print Cycle Completion

The completion phase begins when paper moves toward the toner cartridge and ends when the printed page exits the printer. This section shows the locations and describes the functions of the components that operate during the completion phase.

## Components

The following components which function during the completion phase of a print cycle:

- Laser/scanner assembly
- Toner cartridge
- Drive assembly
- Transfer roller
- High-voltage power supply
- Transfer block assembly
- High-voltage connector block
- Sheet feeder cable
- Fuser access door
- Fuser assembly
- Thermosensor
- Thermoprotector
- Delivery/interlock sensor PS201 and sensor arms
- Delivery roller assembly

## Functions

This section summarizes the functions of the print cycle completion components.

**Important:** Read this section in conjunction with viewing Part 2, "Parts and Functions—Print Cycle Completion" of the *LaserWriter Pro Service Training* videotape. Part 2 identifies the above components and their functions.

- The laser/scanner assembly (see Figure 1-8) generates and scans the laser beam onto the photosensitive drum.

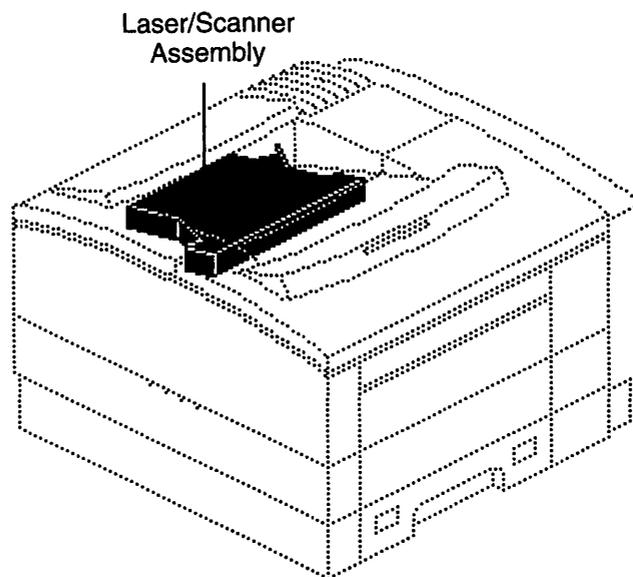
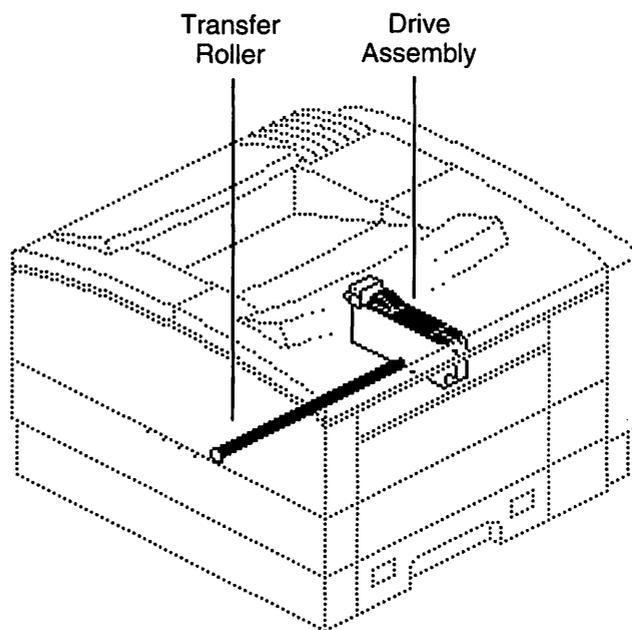


Figure 1-8  
The Laser/Scanner Assembly

## Print Cycle Completion

- The toner cartridge (identified in the videotape) develops the image scanned on to it by the laser/scanner assembly.
- The drive assembly (see Figure 1-9) transfers operation from the main motor to the toner cartridge and the fuser assembly (discussed later in this section).
- The transfer roller (see Figure 1-9), driven by the toner cartridge, puts a charge on the paper as it passes between the roller and the photosensitive drum. The charge causes the image on the photosensitive drum to transfer to the paper.



**Figure 1-9**  
The Drive Assembly and Transfer Roller

- The high-voltage power supply (see Figure 1-10) provides high voltage to the primary roller in the toner cartridge and to the transfer roller.
- The transfer block assembly transfers high-voltage from the high-voltage power supply through the bottom printer chassis to the toner cartridge and the transfer roller (see Figure 1-11).
- The high-voltage connector block (see Figure 1-11) connects the power supply to the high-voltage power supply and to the fuser assembly.

# Print Cycle Completion

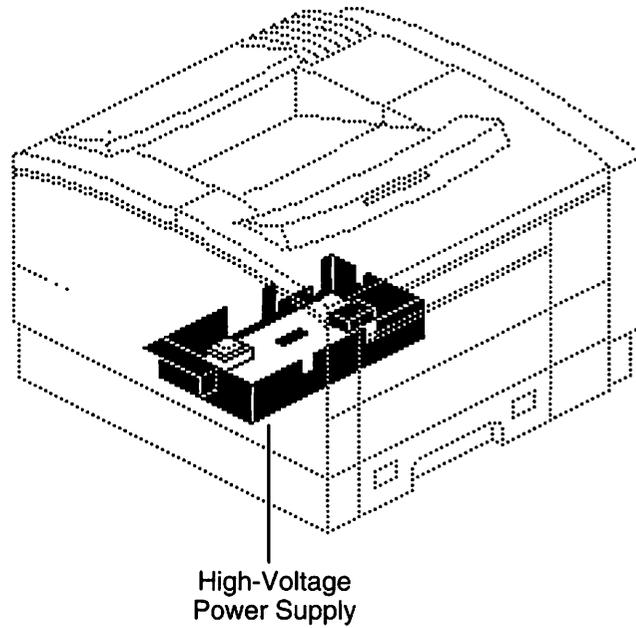


Figure 1-10  
The High-Voltage Power Supply

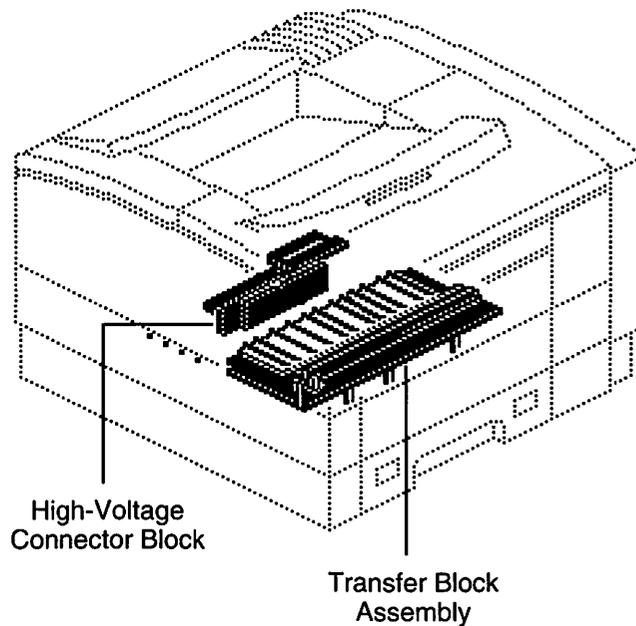


Figure 1-11  
The High-Voltage Connector Block and Transfer Block Assembly, Top View

# Print Cycle Completion

- The sheet feeder cable, located on the bottom of the printer (identified in the videotape), connects the optional 500-sheet feeder controller board to the pickup controller board.
- The fuser assembly (see Figure 1-12) contains: 1) the upper and lower fuser pressure rollers; 2) the thermosensor, which communicates fuser assembly temperature to the DC controller board; 3) the thermoprotector fuse, which cuts off power to the fuser assembly if the heater bulb gets excessively hot; and 4) the heater bulb, which is located in the upper roller. As the page moves between the upper and lower pressure rollers, the heater bulb creates the heat necessary to fuse the toner onto the paper.

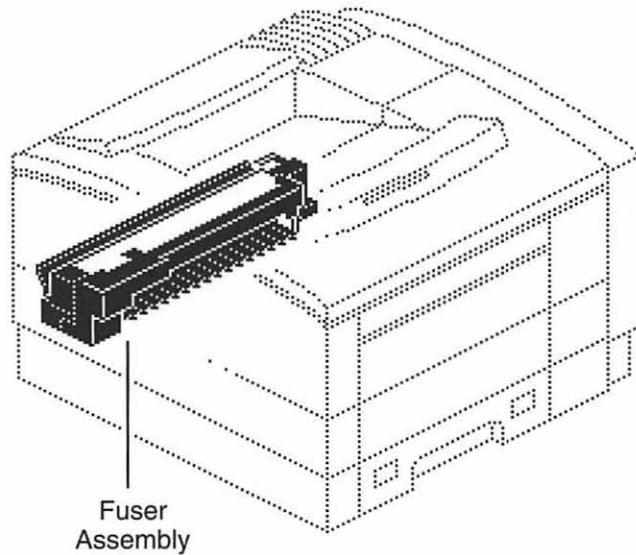


Figure 1-12  
The Fuser Assembly

- The delivery/interlock sensor PS201 and sensor arms (see Figure 1-13) detects when the printed page exits the fuser assembly. If the page fails to clear the delivery/interlock sensor arm within the necessary time, the sensor detects that a paper jam has occurred. The delivery/interlock sensor also cuts off power when the fuser access door is opened.
- The fuser access door (see Figure 1-13) allows access to and removal of the fuser assembly.
- The delivery roller assembly (see Figure 1-14) moves the page, following a c-shaped path, from the fuser assembly to the paper delivery tray on top of the printer.

# Print Cycle Completion

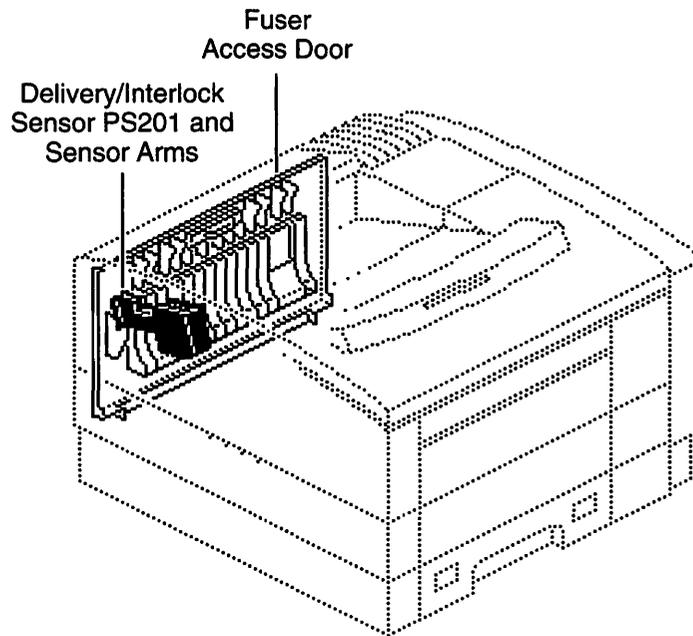


Figure 1-13  
The Delivery/Interlock Sensor PS201, Sensor Arms, and Fuser Access Door

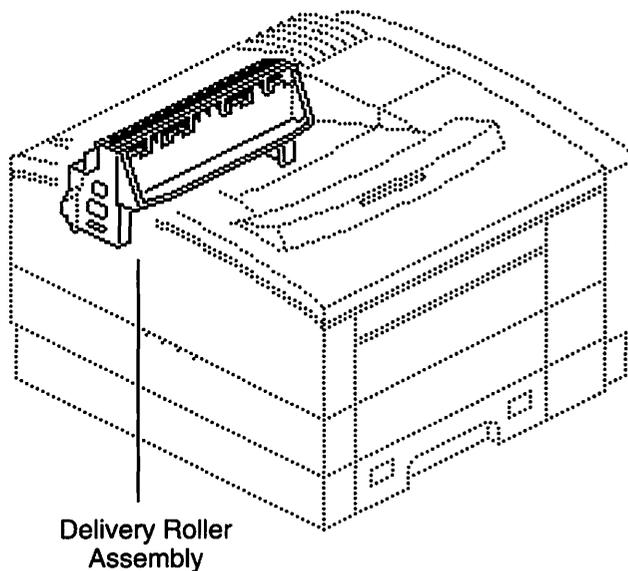


Figure 1-14  
The Delivery Roller Assembly

**Continue with "Practice Exercise 3."**

## Practice Exercise 3

In this exercise you will locate the LaserWriter Pro printer components that function during the completion phase of the print cycle.

**Warning:** The LaserWriter Pro contains potentially dangerous voltage. To eliminate the risk of injury due to shock, make sure that the power cable is disconnected from the printer before beginning this exercise.

Using appropriate reference documents, practice locating each component from the following list until you can locate all components from memory. You may want to ask a colleague to name each item in the list, and then you can point to it.

- Laser/scanner assembly
- Toner cartridge
- Drive assembly
- Transfer roller
- High-voltage power supply
- Transfer block assembly
- High-voltage connector block
- Sheet feeder cable
- Fuser access door
- Fuser assembly
- Delivery/interlock sensor PS201 and sensor arm
- Delivery roller assembly

If you were unable to locate components, review the videotape or the “Parts” chapter in the LaserWriter Pro 600/630 manual on *Apple Service Source*.

**When you are ready, begin “Practice Exercise 4.”**

## Practice Exercise 4

Match the components with their functions by writing the letter of the function in the space below. (Note: Write your answer on a separate piece of paper if this workbook will be used later by other technicians.)

- |                                                  |                                                                                                           |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| — Laser/scanner assembly                         | A. Generates and scans the laser beam onto the photosensitive drum.                                       |
| — Transfer roller                                | B. Puts a charge on the paper, causing the toner image on the photosensitive drum to adhere to the paper. |
| — High-voltage power supply                      | C. Communicates fuser assembly temperature to the DC controller board.                                    |
| — Delivery roller assembly                       | D. Develops the image to be printed.                                                                      |
| — Transfer block assembly                        | E. Moves paper from the fuser assembly to the paper delivery tray.                                        |
| — Fuser assembly                                 | F. Applies pressure and heat to the printed page.                                                         |
| — High-voltage connector block                   | G. Detects when the printed page exits the fuser assembly and when the fuser access door is open.         |
| — Sheet feeder cable                             | H. Transfers power to the primary roller in the toner cartridge and the transfer roller.                  |
| — Delivery/interlock sensor PS201 and sensor arm | I. Provides power through the transfer block assembly to the toner cartridge and transfer roller.         |
| — Thermosensor                                   | J. Connects the power supply to the fuser assembly and the high-voltage power supply.                     |
| — Thermoprotector fuse                           | K. Connects the sheet feeder controller board to the pickup controller board.                             |
| — Toner cartridge                                | L. Transfers main motor operation to the toner cartridge and fuser assembly.                              |
| — Drive assembly                                 | M. Cuts power to the fuser assembly if the heater bulb gets excessively hot.                              |

**When you are finished, compare your answers to those in the answer section that follows.**

## Practice Exercise 4 (Answers)

Compare your answers in "Practice Exercise 4" with those given below.

- A Laser/scanner assembly
- B Transfer roller
- I High-voltage power supply
- E Delivery roller assembly
- H Transfer block assembly
- F Fuser assembly
- J High-voltage connector block
- K Sheet feeder cable
- G Delivery/interlock sensor PS201 and sensor arm
- C Thermosensor
- M Thermoprotector fuse
- D Toner cartridge
- L Drive assembly

If you missed more than three practice items, review this section before continuing.

**When you are ready, proceed to the "Module Test" section.**

## Module Test

Circle the letter of the correct answer for each test item. Complete this test without consulting any reference materials. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicians.)

1. The power supply provides
  - A. AC power to the primary and transfer rollers
  - B. DC power to the fan and transfer roller
  - C. DC power to the DC controller board and AC power to the fuser assembly
  - D. AC power to the DC controller board and DC power to the transfer roller
  - E. AC power to the paper pickup block motor and DC power to the toner cartridge
  
2. The drive assembly transfers operation to the
  - A. Paper pickup block, toner cartridge and fuser assembly
  - B. Toner cartridge and fuser assembly
  - C. Cassette pickup roller, paper pickup block, and toner cartridge
  - D. Multipurpose tray pickup roller and cassette pickup roller
  - E. All of the above
  
3. The delivery/interlock sensor PS201 and sensor arm detect when
  - A. The page leaves the fuser assembly
  - B. The top cover is open
  - C. The page reaches the transfer roller
  - D. Paper is loaded onto the multipurpose tray
  - E. The upper cassette is open
  
4. The pickup controller board controls the
  - A. DC controller board
  - B. Alignment of the paper with the photosensitive drum
  - C. Paper pickup block and the optional envelope and sheet feeders
  - D. Optional envelope and sheet feeders
  - E. Print cycle until the paper reaches the fuser assembly

## Module Test

5. The paper pickup block feeds paper from the
  - A. Fuser assembly to the paper delivery tray
  - B. Transfer roller to the toner cartridge
  - C. Transfer power assembly to the fuser assembly
  - D. Transfer roller to the fuser assembly
  - E. Upper cassette and multipurpose tray to the toner cartridge
  
6. The I/O board
  - A. Controls communication between the printer and external devices
  - B. Controls the pickup controller board
  - C. Provides AC power to the fan and the fuser assembly
  - D. Provides DC power to the DC controller board
  - E. Controls the stages of the print cycle
  
7. The pickup block motor drives the
  - A. Delivery roller assembly and multipurpose pickup roller
  - B. Cassette pickup roller and toner cartridge
  - C. Multipurpose pickup roller and fuser assembly
  - D. Cassette pickup roller and multipurpose pickup roller
  - E. All of the above
  
8. The transfer roller
  - A. Transfers the page from the multipurpose tray to the toner cartridge
  - B. Applies a charge to the page as it passes the toner cartridge
  - C. Transfers the page from the cassette pickup roller to the toner cartridge
  - D. Applies toner to the photosensitive drum as the page passes
  - E. Transfers high voltage to the photosensitive drum
  
9. The fuser assembly
  - A. Fuses the toner on to the photosensitive drum
  - B. Applies heat and pressure to the page after it passes the toner cartridge
  - C. Transfers the developed image from the toner cartridge to the page
  - D. Applies a positive charge to the photosensitive drum which attracts toner from the toner bin to the drum
  - E. Fuses the laser beam on to the photosensitive drum

## Module Test

10. The delivery roller assembly moves the page from the
  - A. Cassette pickup roller to the toner cartridge
  - B. Multipurpose tray to the toner cartridge
  - C. Toner cartridge to the fuser assembly
  - D. Fuser assembly to the paper delivery tray
  - E. Paper pickup block to the delivery guide
  
11. The laser/scanner assembly
  - A. Transfers the printed image to the sheet of paper
  - B. Receives the image to be printed from the toner cartridge
  - C. Generates and scans the laser beam on to the photosensitive drum
  - D. Places a charge on the paper causing the image to transfer
  - E. Scans a high-voltage charge on to the photosensitive drum
  
12. The pickup sensor board
  - A. Controls the paper pickup block
  - B. Contains the paper-end and paper-present sensors
  - C. Aligns the paper with the photosensitive drum
  - D. Determines when the paper exits the fuser assembly
  - E. Senses when the optional 500-sheet feeder is installed
  
13. The multipurpose paper-end sensor PS701 and sensor arm detect
  - A. When the paper has reached the end of the multipurpose tray
  - B. The length of the paper picked up from the multipurpose tray
  - C. When the paper exits the printer
  - D. The location of the front end of the paper
  - E. How long the paper takes to reach the fuser assembly
  
14. The multipurpose paper-present sensor PS702 and arm detect when
  - A. Paper reaches the toner cartridge
  - B. There is paper in either the upper cassette or multipurpose tray
  - C. There is paper in the multipurpose tray
  - D. Paper is jammed in the paper path
  - E. The printed page exits the printer

## Module Test

15. The registration paper sensor PS602 and sensor arm
  - A. Detect whether the paper is evenly fed into the printer
  - B. Synchronize the paper with the transfer roller
  - C. Detect when the printed page has exited the printer
  - D. Synchronize the edge of the paper with the photosensitive drum
  - E. Count the number of pages printed by the I/O controller
  
16. The transfer block assembly
  - A. Transfers the printed page from the transfer roller to the fuser assembly
  - B. Connects the power supply to the high-voltage power supply and fuser assembly
  - C. Transfers high-voltage power to the toner cartridge and to the transfer roller
  - D. Moves the paper from the cassette pickup roller to the paper registration sensor and sensor arm
  - E. Contains the paper pickup block solenoids and gears

**Compare your answers to those on the next page.**

## Module Test (Answers)

1. C
2. B
3. A
4. C
5. E
6. A
7. D
8. B
9. B
10. D
11. C
12. B
13. B
14. C
15. D
16. A
17. C

**If you answered fewer than 14 items correctly, go back and review this module before going on to Module 2—LaserWriter Pro Take-Apart."**



---

## Module 2—Take-Apart Overview

Servicing the LaserWriter Pro depends on your ability to remove and replace components correctly and safely. You will use the information you learned about printer components in the previous module to take apart the LaserWriter Pro printer. The *LaserWriter Pro Service Training* videotape demonstrates how to remove and replace the parts that you will service most often.

### Objectives

When you finish this module, you should be able to take apart and reassemble the LaserWriter Pro printer safely and correctly, without damaging the printer, by following the procedures on the *LaserWriter Pro Service Training* videotape and *Apple Service Source*.

### Required Materials

This module requires the following materials and equipment:

- LaserWriter Pro printer
- Three Phillips #2 screwdrivers—small, medium, and long (magnetized)
- #2 flat-blade screwdriver
- Small flat-blade screwdriver
- Needlenose pliers
- Grounded ESD workstation
- *LaserWriter Pro Service Training* videotape
- *Apple Service Source* CD ROM (February 1996 or later)

### Module Organization

This module has two sections—“Overview” and “Take-Apart Instructions.” This “Overview” provides basic information about the module. The latter section lists the components you will take apart and reassemble according to the procedures in the *LaserWriter Pro Service Training* videotape and *Apple Service Source*.

### Module Test

This module does not have a separate module test. However, you will meet the module objective if you safely reassemble the LaserWriter Pro without damaging any parts and print a user test page.

## Take-Apart Instructions

The following is a list of components you will most frequently replace:

- Rear panel
- Top cover, cover liner and power inlet cover
- Front panel
- I/O shield and I/O board
- Right corner panel
- Multipurpose tray assembly
- Fuser access door
- Fuser assembly
- Delivery roller assembly
- Laser/scanner assembly
- Transfer roller
- DC controller board
- Power supply
- Main motor
- Drive assembly
- High-voltage power supply
- Paper pickup block

Make sure the LaserWriter Pro you take apart is operating properly before you begin. Follow these guidelines to complete this module:

- Review Figure 2-1 on the following pages for an overview of the LaserWriter Pro take-apart. Then review the “Take Apart” chapter in the LaserWriter Pro 600/630 manual and on *Apple Service Source*.
- View “Part 3—Take-Apart and Reassembly” of the *LaserWriter Pro Service Training* videotape. Part 3 demonstrates how to take apart and reassemble the above components. The tape goes to black briefly between each take-apart and reassembly demonstration.

Watch the procedures for one or two parts, use *Apple Service Source* to remove the parts, and then return to the video for each remaining procedure. You are not expected to take apart and reassemble the printer without stopping or pausing the tape.

Carefully read and follow all procedures and cautions presented on *Apple Service Source*. If you fail to use these resources, you will be unaware of special procedures needed to take apart and reassemble the printer properly.

- As you remove and replace each component, check it off on the Take-Apart/Reassembly Checklist at the end of this section. Ask your manager or a colleague to inspect the disassembled printer before beginning reassembly.

**Caution:** Be sure to replace each screw exactly from where it was removed, or you may reduce grounding and cause premature component failure.

# Take-Apart Instructions

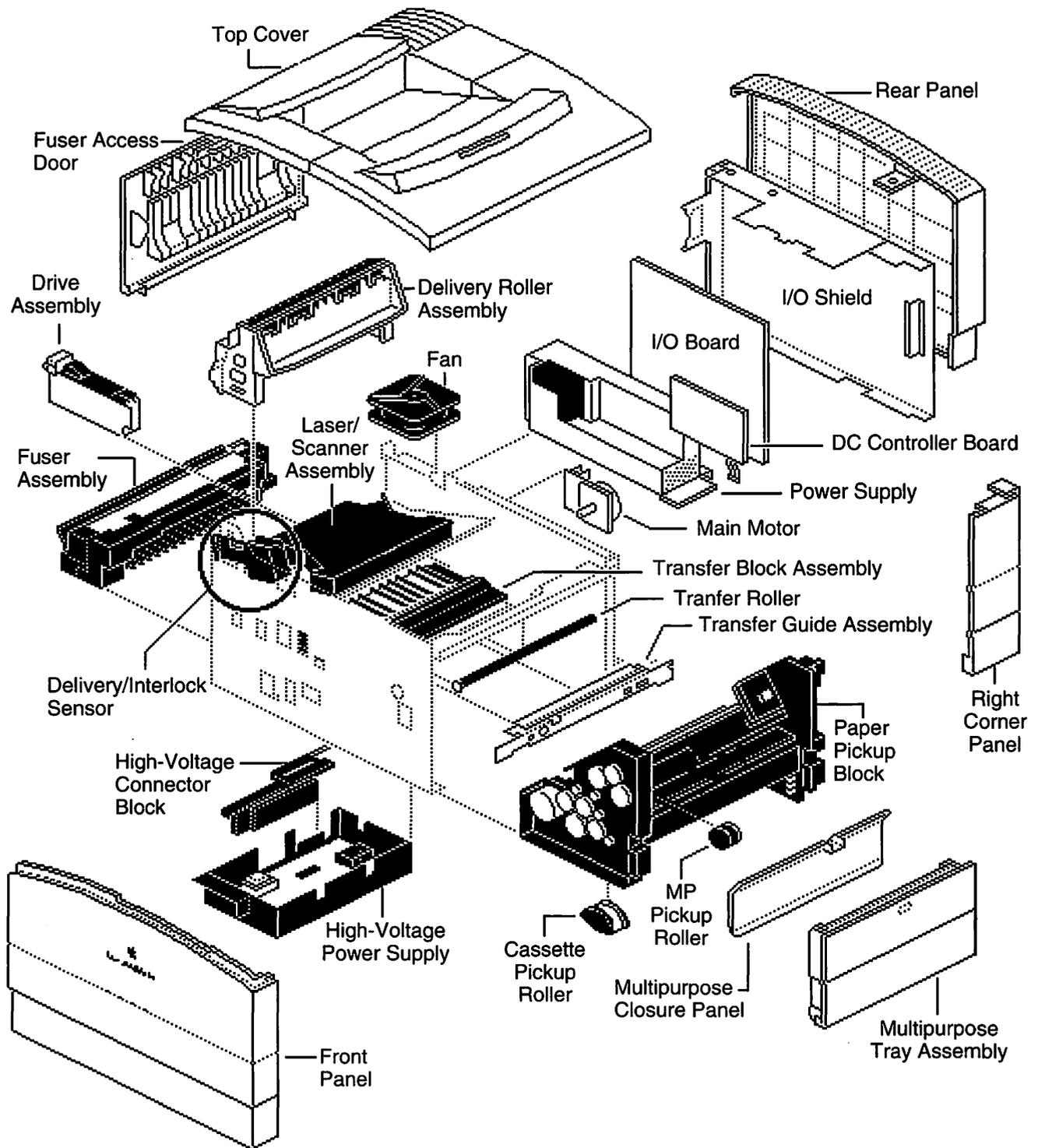


Figure 2-1  
LaserWriter Pro Exploded View

# Take-Apart Instructions

## Take-Apart/Reassembly Checklist

Remove	Replace	
_____	_____	Rear panel
_____	_____	Top cover, cover liner, and power inlet cover
_____	_____	Front panel
_____	_____	I/O shield and I/O board
_____	_____	Right corner panel
_____	_____	Multipurpose tray assembly
_____	_____	Fuser access door
_____	_____	Fuser assembly
_____	_____	Delivery roller assembly
_____	_____	Laser/scanner assembly
_____	_____	Transfer roller
_____	_____	DC controller board
_____	_____	Power supply
_____	_____	Main motor
_____	_____	Drive assembly
_____	_____	High-voltage power supply
_____	_____	Paper pickup block
_____		<b>Verify disassembled printer with your manager or a colleague</b>
	_____	Generate user test page
	_____	<b>Verify reassembled printer and operation with your manager or a colleague</b>

After you perform the tasks on the Take-Apart/Reassembly Checklist, you have completed this module.

**When you are ready, begin the next module, "LaserWriter Pro Troubleshooting."**

# Module 3—Troubleshooting Overview

In the *Introduction to Laser Printer Service* course, you learned troubleshooting procedures for all Apple laser printers. This module builds on that information and presents troubleshooting information and procedures unique to the LaserWriter Pro.

## Objectives

When you finish this module, you should be able to

- Indicate troubleshooting steps when given Apple service reference materials and a description of a LaserWriter Pro failure
- Return a printer to functional condition when given Apple service reference materials and a faulty LaserWriter Pro printer

## Required Materials

This module requires the following materials:

- *LaserWriter Pro Service Training* videotape
- *Apple Service Source* CD ROM (February 1996 or later)
- *Apple Service Guide for LaserWriter Printers*, Volume II

## Module Organization

This module consists of the following sections:

- Overview
- Hands-On Troubleshooting
- Practice Exercise 1
- Module Test—Part 1
- Practice Exercise 2
- Module Test—Part 2

This “Overview” section provides basic information about this module. “Hands-On Troubleshooting” reviews the hands-on troubleshooting process from the *Introduction to LaserWriter Printer Service* course and discusses how and when to use service resources to troubleshoot the LaserWriter Pro.

“Practice Exercise 1” contains questions about how to use your troubleshooting resources and what to do about specific printer problems. “Practice Exercise 2” gives you the opportunity to practice troubleshooting and repairing a faulty printer.

The module test has two parts. Part 1 consists of multiple-choice questions about logical troubleshooting; you should be able to answer with at least 80 percent accuracy. Part 2 directs you to troubleshoot and repair two faulty LaserWriter Pro printers to a set of criteria. Have your manager or a colleague assess how well you meet the criteria.

---

# Hands-On Troubleshooting

This section reviews the hands-on troubleshooting process in the *Introduction to Laser Printer Service* course. We will emphasize the service resources for hands-on troubleshooting the LaserWriter Pro.

## Troubleshooting Process

Perform hands-on troubleshooting when

- You cannot resolve the customer's laser printer problem over the telephone (that is, you must replace a module or part).
- You rule out software, setup, user, and network problems as the cause of the printer malfunction.

Hands-on troubleshooting consists of three major steps:

1. Verify deviation from normal operation.
2. Take troubleshooting/resolution actions.
3. Verify problem resolution.

### Step 1: Verify Deviation From Normal Operation

Begin hands-on troubleshooting by verifying the deviation from normal operation. You cannot be sure that the information given by the customer or written on the work order is 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 recreate the problem. Make sure that you have all the customer's equipment. A problem may be caused by a bad cable, but if you don't have the customer's cable, you won't be able to recreate the problem. If you can't repeat the problem, contact the customer and repeat the customer actions until you see the symptom.

### Step 2: Take Troubleshooting/Resolution Actions

When you have an accurate problem description, you are ready to take actions to further isolate and resolve the problem. Continue troubleshooting and then repair the laser printer by carefully following the step-by-step procedures in the various laser printer service resources that are covered in a later section of this module. Use the service resources to guide you through the most effective and efficient sequence of hands-on troubleshooting actions.

**Important:** Apple strongly encourages you to use these service resources whenever you service laser printers. If you telephone Apple for information or support, the representative will assume you have already exhausted the service resources.

### Step 3: Verify Problem Resolution

After you identify and replace a faulty part, you must thoroughly test the laser printer to verify the repair. Testing is essential for several reasons. First, you may have identified the faulty component, but you may not have identified all the faulty 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 these steps before you return it to the customer:

---

# Hands-On Troubleshooting

1. Set up the laser printer.
2. Run the diagnostics (if available for the printer).
3. Recreate the original problem (if possible).
4. Perform basic functions.
5. Leave the printer on for 24 hours and periodically repeat steps 2–4.

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 put into testing the repair will pay off in customer satisfaction and increased confidence in your service organization.

## Troubleshooting Printer Setup

Check two configuration options, not common to all laser printers, when troubleshooting the LaserWriter Pro printer setup. First, check computer to printer communication. The LaserWriter Pro can be connected to multiple computers and networks via its LocalTalk, serial, parallel, and Ethernet (LaserWriter Pro 630 only) ports so that it is accessible to all users through these ports at the same time. Verify that the push button switch on the I/O controller's connector panel is set to the correct port configuration. Second, check optional hard disk installation. Up to seven internal and external hard disks can be attached to the LaserWriter Pro 630. Verify that normal SCSI installation and configuration procedures have been followed.

Use the LaserWriter Pro LaserWriter Utility program on the *LaserWriter Pro Utility* disk to display, change, or print communication settings and to identify the SCSI ID numbers of any attached hard disks.

## Service Resources

Five service resources are available to help you perform LaserWriter Pro hands-on troubleshooting:

- Printer diagnostics
- *Apple Service Source* (February 1996 or later) and *Companion CD*
- *Apple Service Guide for LaserWriter Printers*, Volume II
- Technical Info Library
- Apple Service Internet website (<http://service.info.apple.com>)

## Printer Diagnostics

The LaserWriter Pro printer's LEDs provide diagnostic information when you install an RS-232 test connector. Printer diagnostics first test the I/O controller board and then the print engine. You can not test the I/O controller or the print engine separately. To invoke diagnostics, switch off the printer, install the connector in the serial port, and switch on the printer. The test can take up to 2.5 minutes to complete.

After invoking the diagnostics, the LEDs will flash on and off in random patterns as the I/O controller board is tested. If a fault is not found with the I/O controller board, the Diagnostic Executing (referred to as the Unknown Engine error in the videotape) LED

# Hands-On Troubleshooting

pattern is displayed as illustrated in Table 3-1. If the printer fails the test, one of the other LED patterns illustrated in Table 3-1 is displayed.

If the Diagnostic Executing (Unknown Engine) LED pattern is still displayed after 2.5 minutes, the diagnostics are unable to identify the faulty module. In this situation, ensure that the printer is not jammed, the doors and covers are closed, and that the printer is properly set up before continuing troubleshooting. If the Diagnostic Executing LED pattern remains displayed, use the LaserWriter Pro 600/630 Flowcharts & Tables from the Troubleshooting chapter on *Apple Service Source* to troubleshoot and repair the printer.

If the test connector is *not* installed, the Paper Out and Paper Jam LEDs illuminate or flash, and the Ready and Toner LEDs are off, when the printer requires service.

## View Videotape

View “Part 4—Printer Diagnostics” of the *LaserWriter Pro Service Training* videotape for demonstration of the printer diagnostics. Then return to this page and continue reading.

Before continuing, read the “Printer Diagnostic” section in the Troubleshooting chapter of the LaserWriter Pro 600/630 manual on *Apple Service Source*, and use your LaserWriter Pro to practice invoking the diagnostics.

## Apple Service Source

*Apple Service Source* will be your primary reference for hands-on troubleshooting and is the most comprehensive service reference for Apple products. The step-by-step technical procedures help you isolate and resolve all laser printer problems in the most effective and efficient manner. In addition, many other useful references are included in the *Apple Service Source* CD suite.

To use *Apple Service Source*, click on both the “Hardware” and “Service Manuals” tabs in the Service Source Startup 2.0 window. Then click on “Printers” and choose either the LaserWriter Pro 600 or the LaserWriter Pro 630 model from the printer product list that appears. You are now in the LaserWriter Pro 600/630 manual of *Apple Service Source*. (To select a different laser printer family or other Apple product, return to the Service Source Startup 2.0 window.) Next, use the bookmarks to the left of the LaserWriter Pro 600/630 manual window to go to the Flowcharts & Tables section in the Troubleshooting chapter. The Flowcharts will usually be the most useful section to you when troubleshooting.

The Flowcharts guide you through a comprehensive check of the LaserWriter Pro, directing you when to use a particular Table for troubleshooting a specific problem. Use the Flowcharts when you have verified a deviation from normal operation, but have *not* yet isolated the problem. Use the appropriate Table when you have isolated the problem to a specific subsystem or component, or to a print quality issue. Choose the

# Hands-On Troubleshooting

Error	Ready	Toner	Paper Out	Paper Jam
Diagnostic Executing (Unknown Engine)	Off	On	On	Off
No Error	On	On	On	On
I/O Board	On	Off	On	Off
Fuser Assembly	On	Off	On	On
Laser/Scanner	On	On	Off	Off
Main Motor	On	On	On	Off
Fan Motor	Off	Off	Off	On
ROM 1	Off	On	Off	Off
ROM 2	Off	On	Off	On
ROM 3	On	On	Off	On
ROM 4	Off	On	On	On
SIMM 1	On	Off	Off	Off
SIMM 2	On	Off	Off	On

Table 3-1  
LaserWriter Pro Diagnostic LED Displays

## Hands-On Troubleshooting

Table which most closely describes the problem you are troubleshooting, and follow the step-by-step procedures.

When troubleshooting, you may also sometimes need to refer to the Specifications or Basics chapters to solve a problem that relates to the setup or inherent capacities of the printer.

After resolving the problem, use the Flowcharts again as a first step in verifying problem resolution. Apple recommends that you also thoroughly test the printer over a period of several hours.

If you have not carefully reviewed the LaserWriter Pro 600/630 manual of *Apple Service Source*, stop here and do so now. You will use *Apple Service Source* to complete the practice exercises and test later in this module. To complete the module test successfully, you must accurately follow the troubleshooting procedures on *Apple Service Source*.

### Apple Service Guides

The *Apple Service Guides for LaserWriter Printers* provides a subset of the most often-used procedures and information on *Apple Service Source* and other laser printer service references. The LaserWriter Pro chapter, located in Volume II, contains several helpful troubleshooting charts and procedures. This portable guide is especially helpful for on-site service calls when *Apple Service Source* is not readily available.

### Technical Info Library

The Technical Info Library (TIL), included with the *Apple Service Source* CD suite and also located on the Apple Service Internet website, is an excellent source of product troubleshooting information and may contain helpful tips that have not been added to either *Apple Service Source* or the *Apple Service Guide for LaserWriter Printers*. Look first on *Apple Service Source* or in the service guide. If you don't find the answer you need, check the TIL.

### Apple Service Website

AppleService Internet website (<http://service.info.apple.com>) contains up-to-the-minute service information that may not yet have been added to *Service Source* CD or the *Apple Service Guides*. (For this month's logon and password, see your current *Service Source* CD.)

These service resources are an essential part of your troubleshooting and repair tools. The more you use them, the more effectively and efficiently you will be able to troubleshoot and repair the LaserWriter Pro.

**Continue with "Practice Exercise 1."**

---

## Practice Exercise 1

Answer the following questions using your course materials and *Apple Service Source* (February 1996 or later edition). Assume you are repairing a LaserWriter Pro at your service center. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicians.)

1. What troubleshooting action should you take first?

---

2. While executing printer diagnostics, this LED pattern displays: Ready-on, Toner-off, Paper Out-on, Paper Jam-off. Which part should you replace?

---

3. The LaserWriter Pro 600 with 4 MB RAM cannot print in PhotoGrade. Referring to the "Engine" section in the Specifications chapter on *Apple Service Source*, what should you do?

---

4. Which chapter and section of the LaserWriter Pro 600/630 manual on *Apple Service Source* should you refer to first when troubleshooting?

---

5. While executing printer diagnostics, this LED pattern appears: Ready-on, Toner-on, Paper Out-on, Paper Jam-off. Which module should you replace?

---

6. You cannot print in PhotoGrade at 600 dpi from a LaserWriter Pro 600 even when the RAM has been upgraded to 8 MB. You want to print at 600 dpi. Using the LaserWriter Pro 600/630 Flowcharts & Tables, what should you do next?

---

## Practice Exercise 1

7. Which chapter and section of the LaserWriter Pro 600/630 manual on *Apple Service Source* should use to begin testing the repaired printer?
- 

8. An application does not allow you access to the print options dialog to turn off PhotoGrade. Referring to the LaserWriter Utility section in the LaserWriter Pro 600/630 Basics chapter, what should you do?
- 

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

---

## Practice Exercise 1 (Answers)

Compare your answers in “Practice Exercise 1” with those provided below.

1. Verify the deviation from normal operation.
2. Replace the I/O controller board.
3. Upgrade RAM to 8 MB or more.
4. First go to the Flowcharts & Tables in the Troubleshooting chapter.
5. Replace the main motor.
6. You cannot print in PhotoGrade at 600 dpi. To print at 600 dpi, upgrade to 12MB RAM or turn off PhotoGrade by clicking Options in the Print dialog box.
7. Refer to Flowcharts & Tables in the Troubleshooting chapter.
8. Use the LaserWriter Utility, version 7.4 or later, to turn off PhotoGrade.

**If you missed more than two of the practice items, review this module before continuing. When you are ready, go on to the Module Test—Part 1 on the next page.**

## Module Test—Part 1

Circle the correct answer to the following questions using your course materials and *Apple Service Source* (February 1996 or later edition). Assume you are repairing a LaserWriter Pro at your service center. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicians.)

1. The LaserWriter Pro 600 with 4 MB RAM cannot print in PhotoGrade. Referring to *Apple Service Source*, what should you do?
  - A. Use Imaging Options in the LaserWriter Utility to turn on PhotoGrade.
  - B. Select PhotoGrade in the Print dialog.
  - C. Replace the DC controller board.
  - D. Use an application that prints in PhotoGrade.
  - E. Upgrade RAM to at least 8 MB.
  
2. The LaserWriter Pro 630 prints properly, but the toner is not fused to the paper. Using LaserWriter Pro 600/630 Flowcharts & Tables, what should you do?
  - A. Replace the toner cartridge.
  - B. Insure that the fuser roller levers are set to print mode.
  - C. Check the voltage drawn by the heater bulb.
  - D. Replace the fuser assembly.
  - E. Clean the transfer roller.
  
3. While executing printer diagnostics, this LED pattern appears: Ready—on, Toner—off, Paper Out—off, Paper Jam—off. Which module should you replace?
  - A. I/O board
  - B. Laser/scanner assembly
  - C. SIMM 2
  - D. ROM 3
  - E. SIMM 1
  
4. Which is the earliest version of LaserWriter driver required to print with PhotoGrade?
  - A. 6.7
  - B. 6.9
  - C. 7.2
  - D. 7.5
  - E. 7.8

---

## Module Test—Part 1

5. Which chapter and section of the LaserWriter Pro 600/630 manual on *Apple Service Source* should you mostly use when troubleshooting?
  - A. Basics: Test/Configuration Pages
  - B. Specifications: Engine
  - C. Troubleshooting: Flowcharts & Tables
  - D. Troubleshooting: Circuit Board Diagrams
  - E. Basics: LaserWriter Utility
  
6. Which chapter and section of the LaserWriter Pro 600/630 manual on *Apple Service Source* should you use to begin testing the repaired printer?
  - A. Troubleshooting: Flowcharts & Tables
  - B. Specifications: Engine
  - C. Basics: Test/Configuration Pages
  - D. Troubleshooting: General
  - E. Basics: LaserWriter Utility
  
7. While executing printer diagnostics, the following LED pattern has just appeared: Ready—off, Toner—on, Paper Out—on, and Paper Jam—off. What should you do?
  - A. Replace the laser/scanner assembly.
  - B. Execute the diagnostics a second time.
  - C. Refer to Flowcharts & Tables on *Apple Service Source*.
  - D. Wait until the diagnostics have run at least 2.5 minutes.
  - E. Replace the I/O controller board.
  
8. Which chapter of the LaserWriter Pro 600/630 manual on *Apple Service Source* describes the diagnostic LEDs?
  - A. Basics
  - B. Troubleshooting
  - C. Adjustments
  - D. Specifications
  - E. Upgrades

**When you are finished, compare your answers to those on the next page.**

## Module Test—Part 1 (Answers)

Compare your answers to Module Test—Part I to those below.

1. E
2. B
3. E
4. C
5. C
6. A
7. D
8. B

**If you missed more than one item, go back and review the module before you go on to the final practice exercise and test.**

## Practice Exercise 2

This final practice exercise gives you an opportunity to troubleshoot and repair a faulty LaserWriter Pro printer. After you complete this exercise, you will begin Part 2 of the module test, which directs you to troubleshoot and repair two LaserWriter Pro printers to a set of more rigorous criteria.

Follow these directions to complete the practice exercise:

1. Ask your manager or a colleague to assign you a faulty LaserWriter Pro to troubleshoot and repair.
2. Make a copy of the “Troubleshooting and Repair Record” form (Figure 3-1 on the next page). As you complete each troubleshooting stage, fill in your copy of the form (do not write on the form in this workbook).
3. Complete the three stages of hands-on troubleshooting: 1) verify deviation from normal operation, 2) take troubleshooting/resolution actions, and 3) verify problem resolution.

Use your copy of the “Troubleshooting and Repair Record” form to create a detailed listing of the actions you perform to troubleshoot and repair the printer. When you check or replace components, print a service test page, or refer to *Apple Service Source*, list your actions in the order you perform them. Write the name of the parts you check or replace and the names of the submenus you refer to on *Apple Service Source*. Be sure to closely follow the procedures as presented on *Apple Service Source*.

In the second column of the form, state the reason you performed each action. For example, if you check whether a toner cartridge is installed, you might write “The motor was not operational. The Flowchart directed me to...”

The purpose of the “Troubleshooting and Repair Record” is to allow your manager or colleague to review the actions you performed and give you feedback on the appropriateness and effectiveness of the actions you took. The more detailed your record, the more specific and helpful the feedback can be.

4. When you have finished repairing the printer, ask your manager or colleague to review your “Troubleshooting and Repair Record.”

Now you are ready to go on to Module Test—Part 2, troubleshooting to a set of criteria.

## Practice Exercise 2

### Troubleshooting And Repair Record

Your name \_\_\_\_\_

Laser printer to be repaired \_\_\_\_\_

Deviation from normal operation \_\_\_\_\_

Repair solution \_\_\_\_\_

Directions:  
Provide the information requested above and complete the "Action Taken" and "Reason for Taking the Action" sections for each action you take. Be very specific.

1	Action Taken	Reason for Taking the Action
2		
3		
4		
5		
6		

Continue on the reverse side of this form for more space.

Figure 3-1  
Troubleshooting And Repair Record Form

---

## Module Test—Part 2

This second and final part of the module test requires you to troubleshoot and repair two LaserWriter Pro printers according to a set of rigorous criteria. Before you begin this part of the test, look at the Troubleshooting Criteria given on the next page. These are the standards you should be able to achieve as you troubleshoot the two printers.

When you are ready, follow these directions to complete Part 2 of the module test:

1. Ask your manager or colleague to assign you a LaserWriter Pro printer to troubleshoot and repair.
2. Troubleshoot and repair the printer following the procedures in this module and on *Apple Service Source* and according to the Troubleshooting Criteria listed on the next page.
3. Record and explain the reasons for each of your actions on a copy of the “Troubleshooting and Repair Record” form, as you did in the practice exercise.
4. After you have repaired the first printer, ask your manager or colleague to review your “Troubleshooting and Repair Record” and rate you on the Troubleshooting Criteria listed on the next page.
5. Then complete steps 2–4 for the second printer assigned to you.

**When you have successfully repaired two LaserWriter Pro 600/630 printers according to the Troubleshooting Criteria, you have successfully completed the LaserWriter Pro 600/630 Service Training Course. Congratulations!**

## Troubleshooting Criteria

You should be able solve one of the troubleshooting problems in Module Test—Part 2 with a perfect score (8) and the other with a score of at least 6 points, based on the Troubleshooting Criteria point system below (one point for each item). The first four items should be considered required points.

- \_\_\_\_\_ The system is repaired and operating within Apple's specifications.
- \_\_\_\_\_ You followed Apple safety precautions and ESD rules.
- \_\_\_\_\_ You did not damage the equipment.
- \_\_\_\_\_ You used no extra parts in repairing the system (when the repaired system is returned to your manager or colleague, only faulty parts have been replaced; if a "good" module or parts is swapped out in the course of troubleshooting, the good original parts must be reinstalled into the system before demonstrating that the system is repaired).
- \_\_\_\_\_ You correctly identified the problem (isolated it to the correct module or software level).
- \_\_\_\_\_ You had no more than one hint from your manager or colleague.
- \_\_\_\_\_ You demonstrated proper take-apart skills, logical troubleshooting methods, and appropriate use of tools and references; the following must be avoided:
  - Making a mistake that could be avoided by using proper references
  - Using improper tools or procedures
  - Failing to use specialized tools for specific procedures
  - Using illogical troubleshooting procedures
  - Breaking plastic tabs and connectors
  - Replacing and/or folding cables incorrectly
  - Tearing and/or pinching cables
  - Replacing screws in the wrong locations
- \_\_\_\_\_ You can correctly indicate whether this repair involved an exchange module.



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