



LaserWriter II  
Service Course

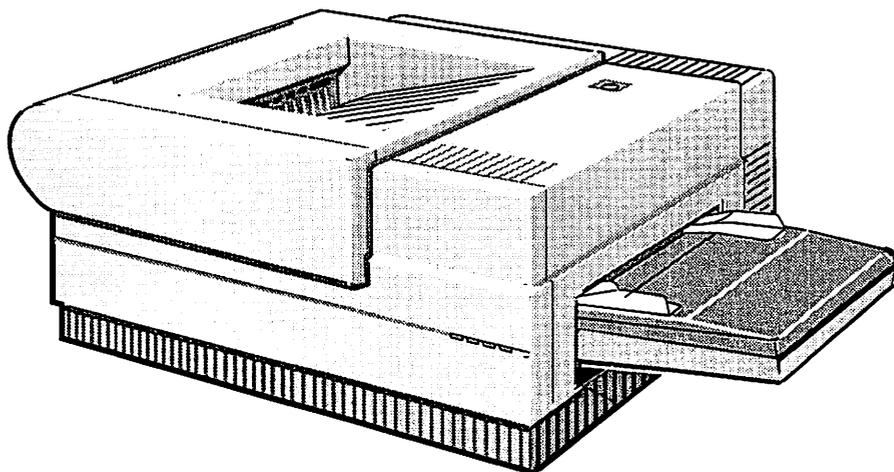
# Service Training



Participant Manual  
Version 1.1

---

# LaserWriter II Service Course



© 1992, 1996 Apple Computer, Inc.

Apple, the Apple logo, AppleTalk, AppleLink, HyperCard, LaserWriter, LocalTalk, and Macintosh are trademarks of Apple Computer, Inc. and are registered in the U.S. and other countries. PostScript is a registered trademark of Adobe Systems Incorporated.

---

# Table of Contents



<b>Section</b>	<b>Page</b>
<b>Introduction</b>	iii
<b>LaserWriter II Parts and Functions</b>	
Overview	1
Objectives	1
Required Materials	1
Module Organization	1
Module Test	1
Printer Overview	3
I/O Board Overview	5
LaserWriter IISC I/O Board	5
LaserWriter IINT and IINTX I/O Boards	7
LaserWriter IIf and IIg I/O Boards	9
LaserWriter Utility	10
Print Engine Overview	11
Power Distribution System	12
System Overview	12
Component Functions	14
Practice Exercise 1	15
Practice Exercise 2	16
Control System	18
System Overview	18
Component Functions	19
Practice Exercise 3	20
Practice Exercise 4	21
Image Formation System	23
System Overview	23
Component Functions	23
Practice Exercise 5	26
Practice Exercise 6	27
Pickup/Feed System	29
System Overview	29
Component Functions	30
Practice Exercise 7	32
Practice Exercise 8	33
Operational Sequence	35
Print Command	35
User Test Page	35
Status Panel	36
Main Motor	36
Scanning Motor	37
	45



---

# Table of Contents

<b>LaserWriter II Parts and Functions (continued)</b>	
Pickup/Registration Rollers	37
Paper Delivery Sensor	37
High-Voltage Power Supply	37
Preconditioning Exposure Lamp	38
Drum Sensitivity Switches	38
Primary Corona	38
Laser Beam	39
Developing Cylinder	39
Transfer Corona	39
LaserWriter IIf and IIg Operational Overview	40
Practice Exercise 9	43
Module Test	45
<b>LaserWriter II Take-Apart</b>	
Overview	51
Objectives	51
Required Materials	51
Module Organization	51
Module Test	51
Take-Apart Instructions	52
<b>LaserWriter II Troubleshooting</b>	
Overview	55
Objectives	55
Required Materials	55
Module Organization	55
Module Test	55
Hands-On Troubleshooting	56
Troubleshooting Process	56
Service Resources	57
Practice Exercise 1	59
Module Test—Part 1	62
Hands-On Troubleshooting Practice	66
Module Test—Part 2	68
<b>Appendix A</b>	
Wiring Diagram	

---

# Introduction



Welcome to the LaserWriter II Service Training Course!

This course provides you with the opportunity to practice the skills you need to service the Apple® LaserWriter®II family of printers. The course covers the following three topics:

1. Parts and Functions
2. Take-Apart and Reassembly
3. Troubleshooting

Each module lists the module objectives and activities you need to complete to prepare for the module test. To get the most from this course, follow these five steps:

1. Begin with the first module—“LaserWriter II Parts and Functions.”
2. Read 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 (if present) after you complete the module activities.
4. Ask your service manager or a colleague to review your work after you complete the module activities and/or test.
5. Repeat steps 2–4 for each remaining module.

**When you are ready, begin the first module—“LaserWriter II Parts and Functions.”**



# Overview



To troubleshoot the LaserWriter II printer, you must be able to identify the locations and functions of the four LaserWriter II subsystem major components. This module presents each LaserWriter II printer subsystem, identifies the major subsystem components, and describes the function of each component.

## Objectives

After completing this module, you will be able to

- locate the major components of each LaserWriter II subsystem.
- match a list of LaserWriter II subsystem components with their functions.

## Required Materials

This module requires the following materials and equipment:

- LaserWriter II printer with the upper main body panels and I/O board removed and a detached laser unit
- *LaserWriter II Service Training* videotape, first section (Parts and Functions)
- *Apple Service Source* CD, version 2.0 (February 1996 or later)

## Module Organization

This module includes the following ten sections:

- Overview
- Printer Overview
- I/O Board Overview
- Print Engine Overview
- Power Distribution System
- Control System
- Image Formation System
- Pickup/Feed System
- Operational Sequence
- Module Test

## Module Test

When you complete all the module activities, ask your service manager or a colleague to check how accurately you can locate LaserWriter II subsystem components by pointing to them. Then you will complete a written test that requires you to match components with their functions. You should be able to answer 80 percent of the questions correctly to pass both parts of the test.



---

# Printer Overview

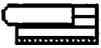


The LaserWriter II printer has two main functional areas: the I/O PCB and the print engine. The I/O PCB provides the interface between the computer or network and the laser printer. The QuickDraw Laser Printer I/O PCB communicates with the Macintosh via the SCSI connector or the serial port. The PostScript laser printer I/O PCB communicates with a network using AppleTalk protocols over LocalTalk or EtherTalk media.

The print engine includes the following four subsystems:

- Power Distribution System
- Control System
- Image Formation System
- Pickup/Feed System

Figure 1-1 on the next page shows the relationship of the I/O PCB to the four laser printer subsystems.



# Printer Overview

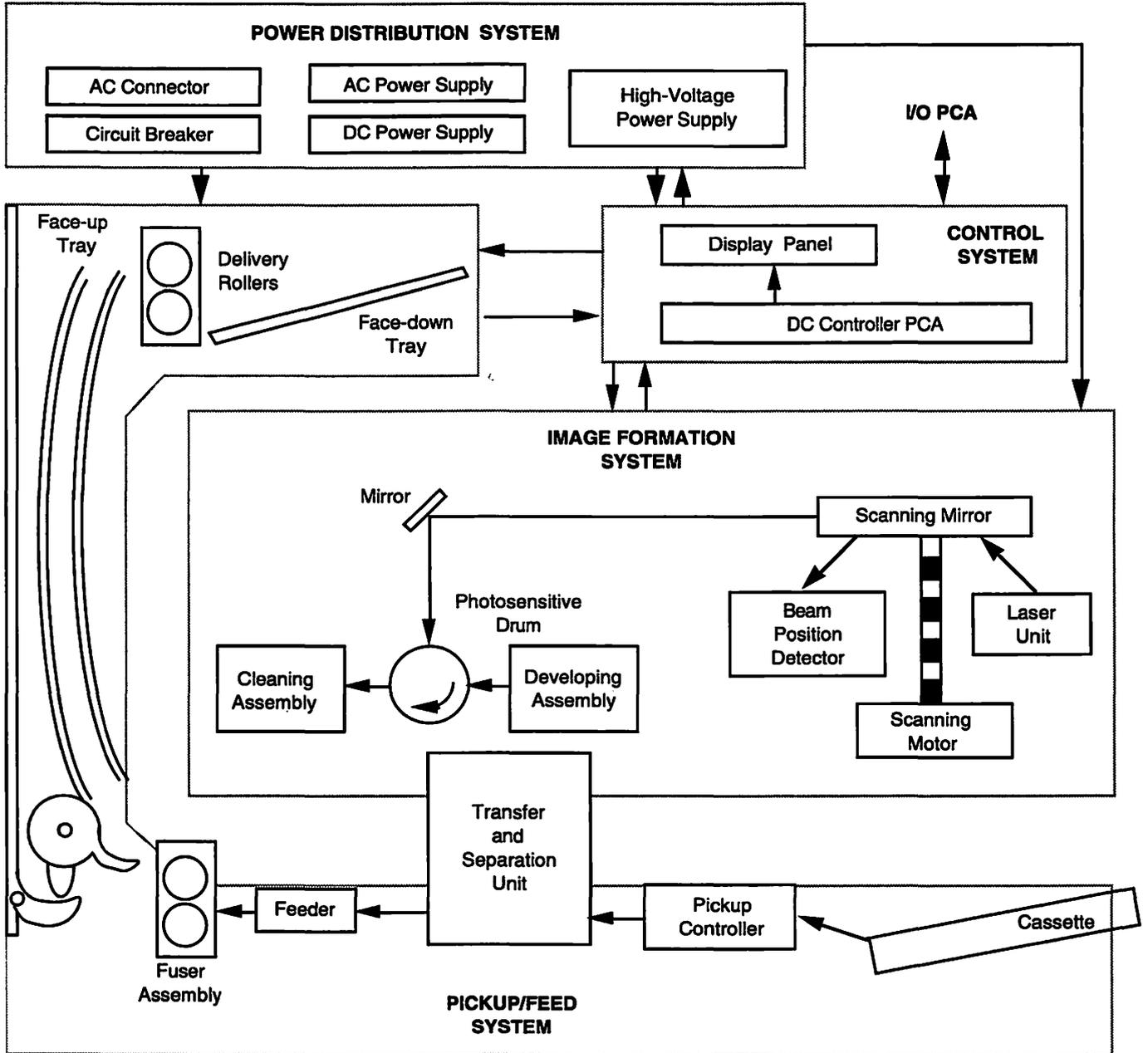


Figure 1-1  
The four LaserWriter II subsystems

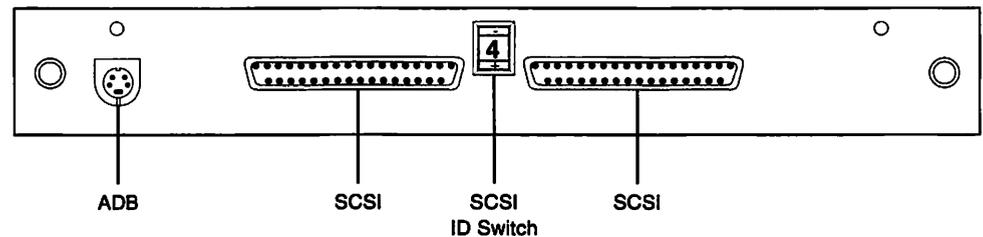
# I/O Board Overview



First we'll take a look at the I/O boards for the LaserWriter IISC, IINT, IINTX, IIF, and IIG printers.

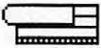
## LaserWriter Iisc I/O Board

The LaserWriter IISC I/O PCB is an electronic circuit board that provides a SCSI (Small Computer System Interface) connection between the print engine and computer. The I/O controller board connects to the print engine via a 32-pin right-angle connector that engages when the I/O controller board slides into the guide rails in the base of the print engine. Use standard Apple SCSI cables to attach the I/O board to the computer. Figure 1-2 shows the LaserWriter IISC I/O PCB back panel.



**Figure 1-2**  
The LaserWriter Iisc I/O PCB back panel

Figure 1-3 on the next page shows the LaserWriter IISC I/O PCB.



# I/O Board Overview

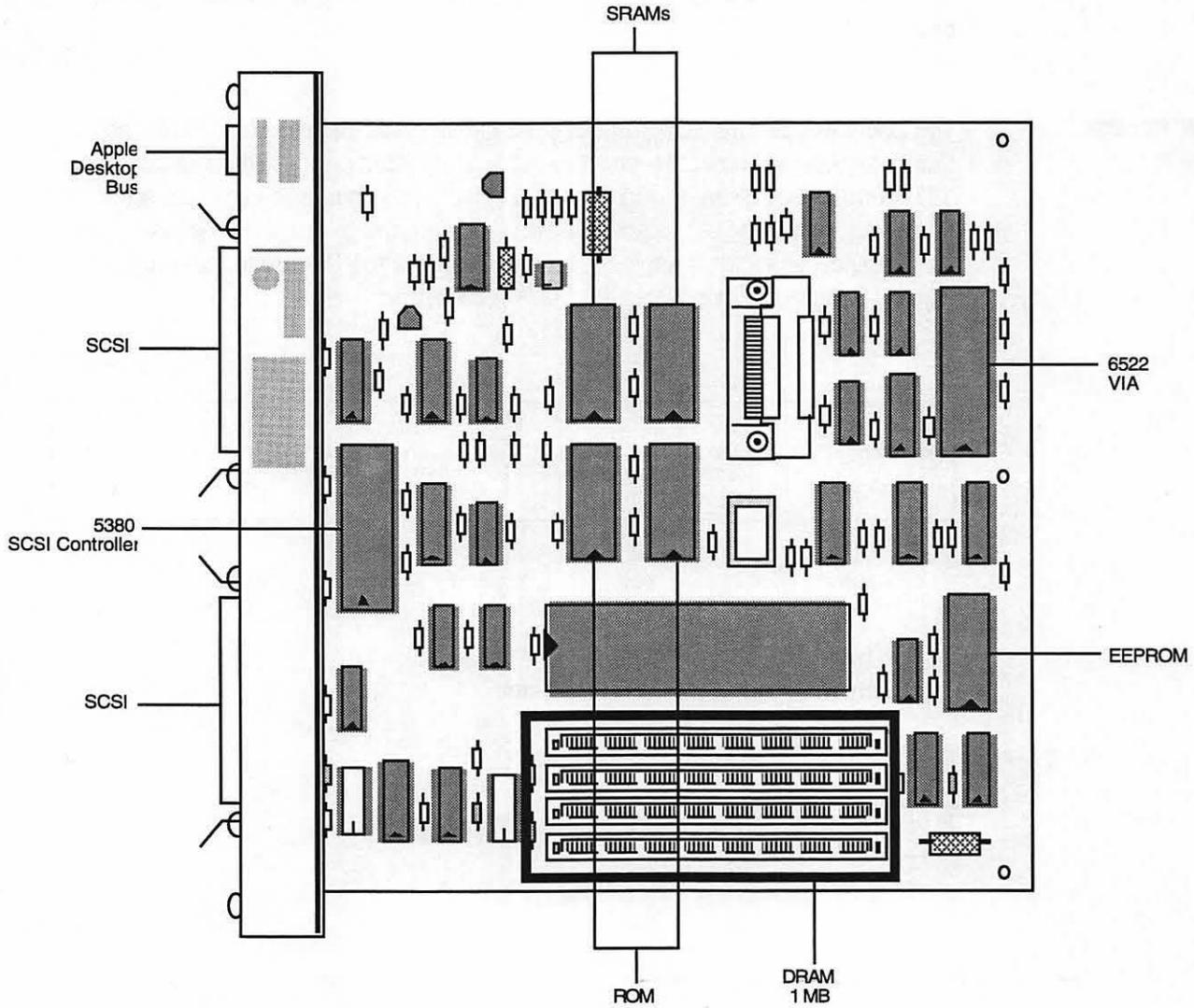


Figure 1-3  
The LaserWriter IIsc I/O PCB

# I/O Board Overview



## LaserWriter IINT and IINTX I/O Boards

The LaserWriter IINT and IINTX I/O PCBs are electronic circuit boards that interface between the LaserWriter II print engine and Apple computers over a LocalTalk network or through an RS-232 interface. The I/O controller board connects to the print engine via a 32-pin right-angle connector that engages when the I/O controller board slides into the guide rails in the base of the print engine. Use Standard LocalTalk or serial interface cables to attach the I/O board to the computer. Figure 1-4 shows the LaserWriter IINT I/O PCB back panel and I/O PCB. Figure 1-5 on the next page shows the LaserWriter IINTX I/O PCB back panel and I/O PCB.

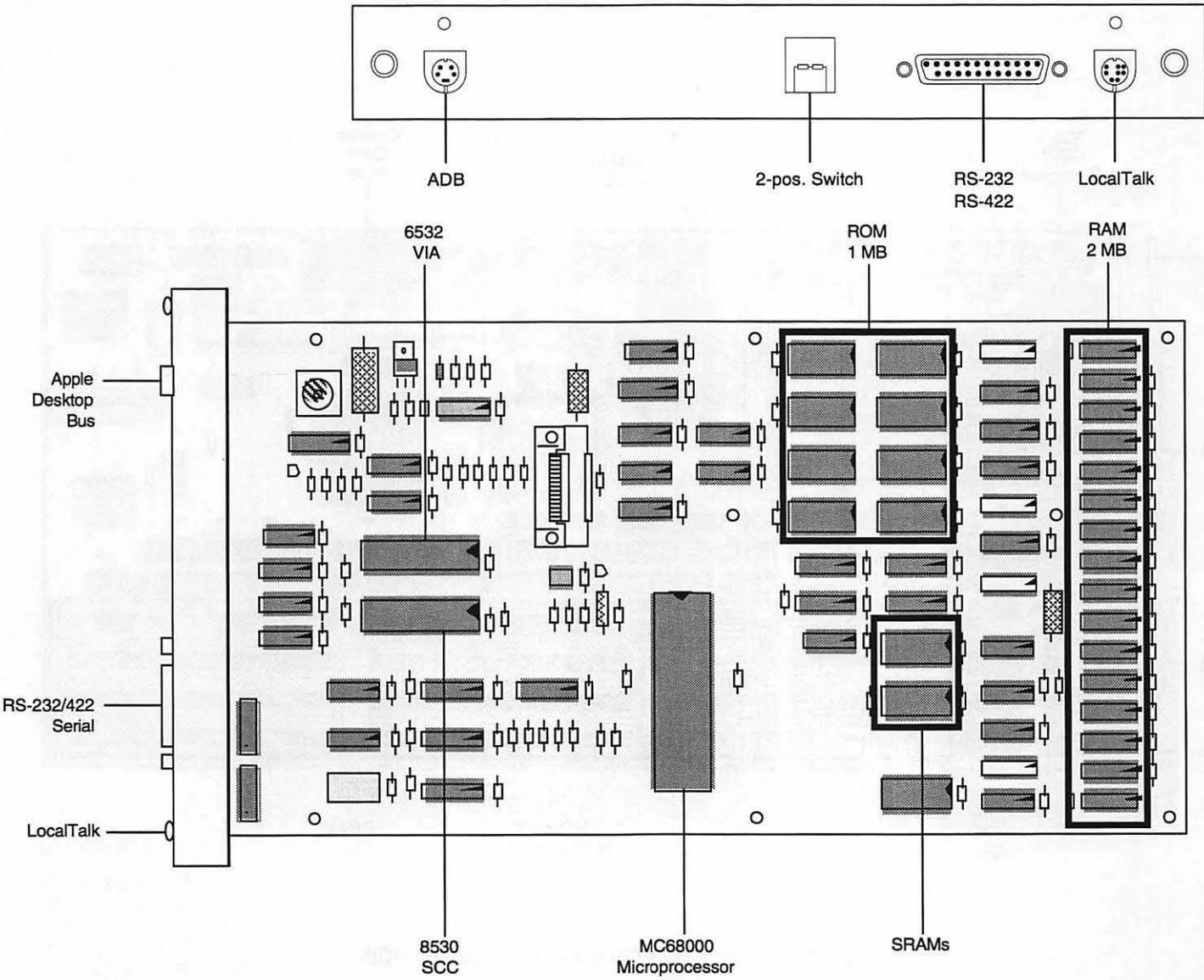


Figure 1-4  
The LaserWriter IINT I/O PCB back panel and I/O PCB



# I/O Board Overview

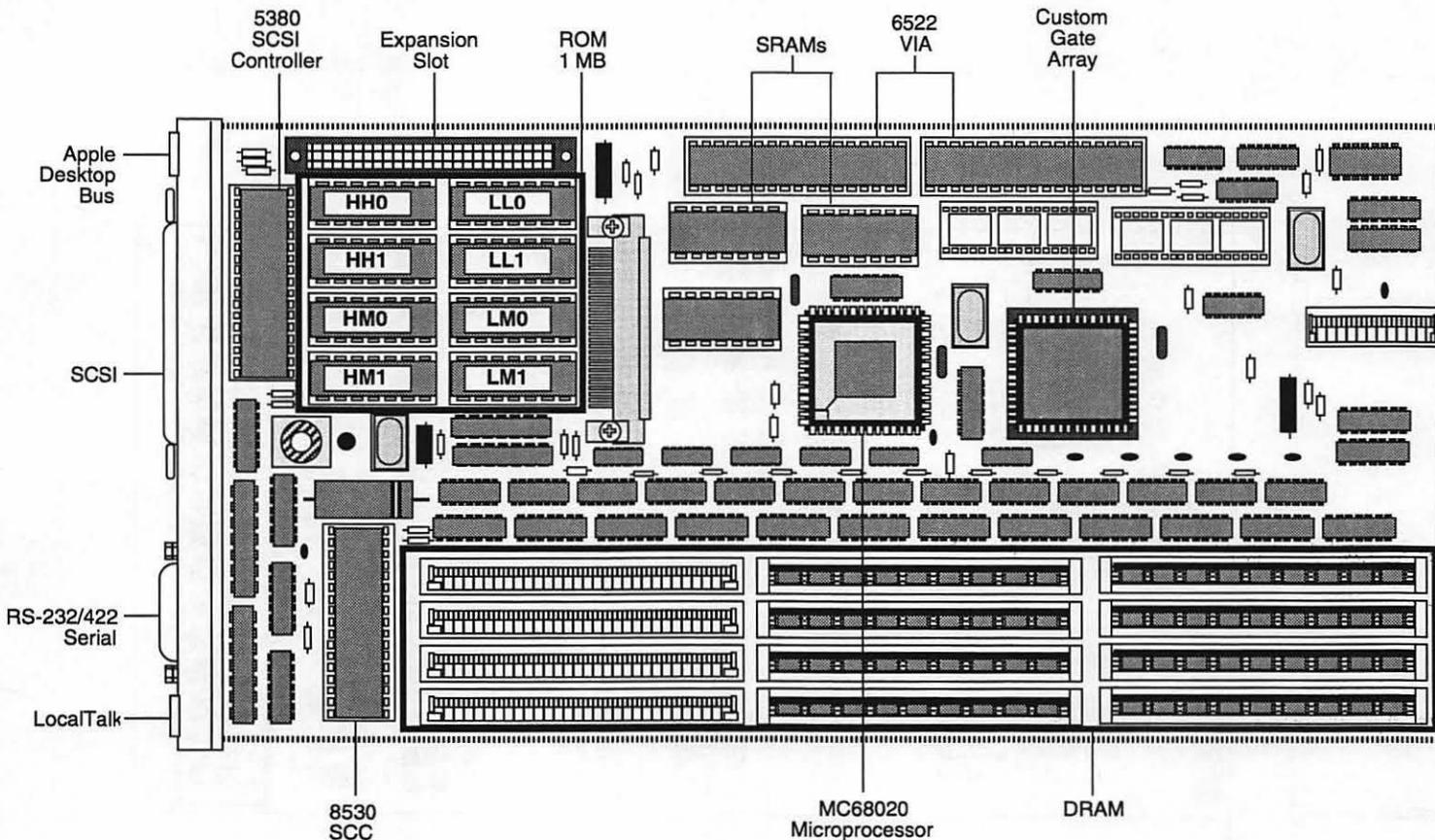
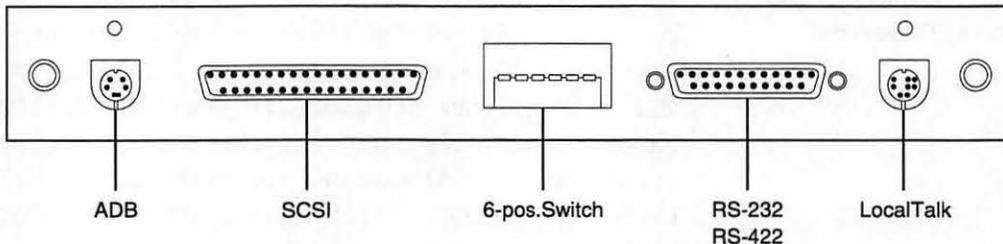


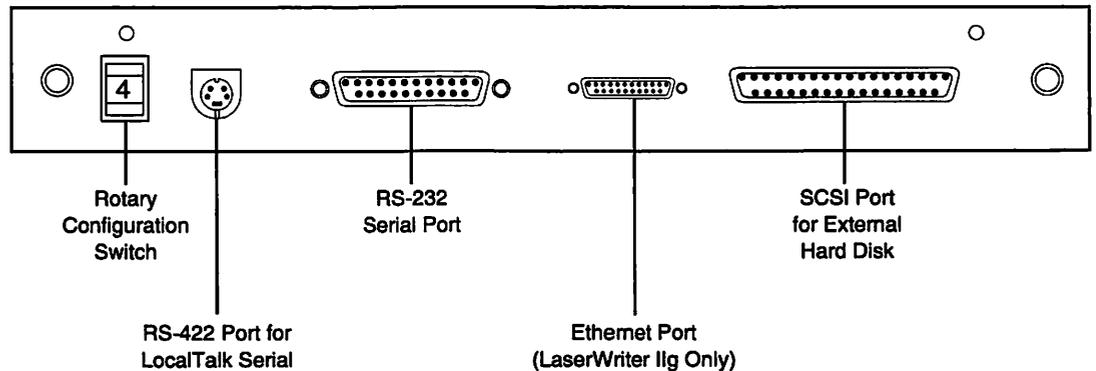
Figure 1-5  
The LaserWriter IINTX I/O PCB back panel and I/O PCB

# I/O Board Overview



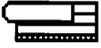
## LaserWriter II<sup>f</sup> and II<sup>g</sup> I/O Boards

The LaserWriter II<sup>f</sup> and II<sup>g</sup> I/O PCBs incorporate several ports. To set up or troubleshoot the LaserWriter II<sup>f</sup> and II<sup>g</sup>, you must be familiar with the location and function of the printer ports shown in Figure 1-6.



**Figure 1-6**  
The LaserWriter II<sup>f</sup> and II<sup>g</sup> I/O PCB back panel

The rotary configuration switch in Figure 1-6 controls the printer communication mode and can be set to any position from 0 to 9. Positions 0–5 are fixed. Users can set positions 6–9 to match the communication needs of their particular computer. To learn more about setting up and using the LaserWriter II<sup>f</sup> and II<sup>g</sup>, consult the *LaserWriter II<sup>f</sup> and II<sup>g</sup> Owner's Guide*.



## I/O Board Overview

### **LaserWriter Utility**

The Macintosh software application *LaserWriter Utility* ships with each LaserWriter IIf and IIg computer. This utility allows users to

- Name the printer
- Inhibit the start-up page
- Determine the total number of pages the LaserWriter IIf or IIg has printed
- Turn FinePrint on and off
- Control the LaserWriter IIg PhotoGrade feature
- View or change communication settings
- Send PostScript files and programs to the printer
- Restart the printer
- Download fonts to the printer
- See or print examples of the available fonts

To set up, use, or troubleshoot a LaserWriter IIf and IIg, you should be familiar with the features and use of the *LaserWriter Utility* (features and use of the *LaserWriter Utility* vary slightly according to the version). Consult the *LaserWriter IIf and IIg Owner's Guide* for detailed information about the *LaserWriter Utility*.

**Continue with the next section—"Print Engine Overview."**

---

# 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.

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.

Before you begin the sections that follow on the LaserWriter II subsystem components, review the LaserWriter II “Basics” and “Parts” chapters of *Apple Service Source*. *Service Source* will help you locate the LaserWriter II components as they are presented in this section of the module.

**Continue with the “Power Distribution” section on the next page.**



## Power Distribution System

### **System Overview**

This section identifies and defines the major components of the power distribution system. By knowing the location and function of each part, you will be able to quickly and accurately troubleshoot and repair LaserWriter II printers.

Figure 1-7 on the next page illustrates the relationship of the power distribution system to the other three LaserWriter II printer subsystems.

# Power Distribution System

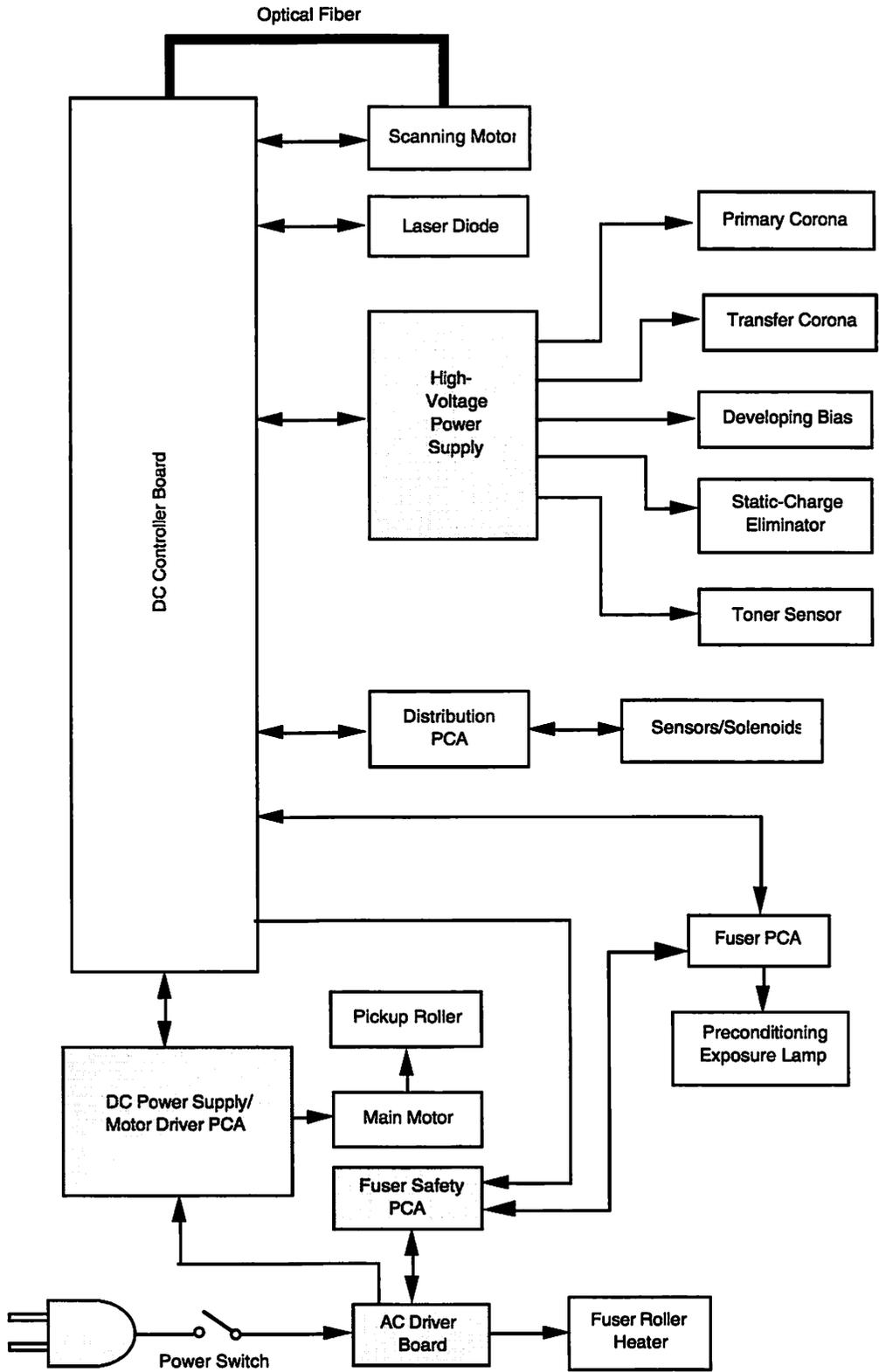


Figure 1-7  
The LaserWriter II power distribution system



## Power Distribution System

### Component Functions

This section describes the functions of the power distribution system major components.

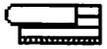
- The power supply block, located at the rear of the printer, contains the main power switch, circuit breaker, AC driver PCA, and fuser safety PCA. The fuser safety PCA controls the heat generated by the fuser heater bulb.
- The upper fan, located above the power supply block, is the exhaust fan for the space above the chassis.
- The lower fan, located under the power supply block with the controller boards, is the exhaust fan for the space inside the base cover.
- The DC power supply supplies power to the main motor and DC controller PCB.
- The high-voltage power supply, located at the front of the printer, provides high-voltage DC power to the primary corona and transfer corona.

Now view Part 1, "Power Distribution System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape. After watching Part 1, you should be able to locate the power distribution system components and define their functions.

**Continue with Practice Exercise 1 on the next page.**

---

# Practice Exercise 1



## Directions

This exercise gives you the opportunity to locate the LaserWriter II power distribution system components. **Caution:** The power distribution system contains potentially dangerous voltage. To eliminate the risk of injury due to shock, disconnect the power cable from the LaserWriter II printer before you begin this exercise.

1. Using appropriate reference documents, practice locating the components in the list below until you can locate all components from memory.
2. Ask your service manager or a colleague to name each item in the list below so you can point to it.
  - Power supply block
  - Upper fan
  - Lower fan
  - DC power supply
  - High-voltage power supply

If you are unable to locate some parts, review Part 1, "Power Distribution System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape or the LaserWriter II "Parts" chapter of *Service Source*.

**When you are ready, complete Practice Exercise 2 on the next page.**



## Practice Exercise 2

### Directions

Match the power distribution system components with their functions by writing the letter of the function in the space provided. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

- |                               |  |
|-------------------------------|--|
| ___ Power supply block        | A. Exhaust fan for the space inside the base cover.                                      |
| ___ Upper fan                 | B. Contains the main power switch, circuit breaker, AC driver PCA, and fuser safety PCA. |
| ___ Lower fan                 | C. Supplies power to the main motor and DC controller PCB.                               |
| ___ DC power supply           | D. Provides high-voltage DC power to the primary corona and transfer corona.             |
| ___ High-voltage power supply | E. Exhaust fan for the space above the chassis.  |

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

---

## Practice Exercise 2 (Answers)

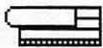


Compare your answers to Practice Exercise 2 with the answers below.

- B Power supply block
- E Upper fan
- A Lower fan
- C DC power supply
- D High-voltage power supply

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

**When you are ready, begin the "Control System" section on the next page.**



## Control System

### System Overview

This section defines the major components of the control system. Figure 1-8 illustrates the relationship of the DC controller—the major module of the LaserWriter II control system—to the computer and LaserWriter printer.

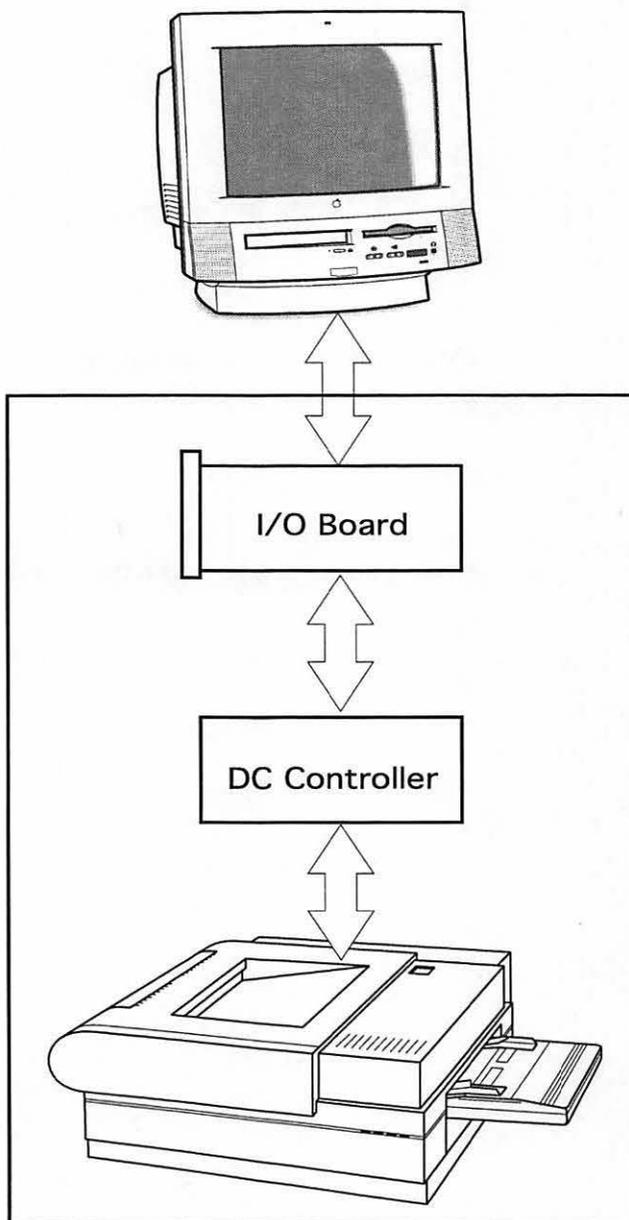


Figure 1-8  
DC controller, computer, and LaserWriter printer relationship

---

# Control System



**Component Functions** This section describes the functions of the control system major components.

- The I/O PCB, located at the bottom of the printer, controls communications between the printer and external computers.
- The DC controller PCB, located above the I/O PCB on the bottom of the printer, is the LaserWriter II “command center.” The DC controller PCB controls and monitors the other three printer systems, including power distribution, image formation, and pickup/feed.
- The interlock switch, located inside the printer at the top of the DC power supply, cuts off power to the printer when the upper unit opens. The interlock lever powers the printer when the upper unit closes and presses down on the interlock switch.
- The toner cartridge sensitivity switches (SW301 and SW302), located on the distribution PCA next to the DC power supply and main motor assembly, help the DC controller match laser beam intensity to drum sensitivity. The drum sensitivity cams on the exterior of the toner cartridge determine the drum sensitivity.
- The status panel, located on the printer front panel, has four indicator lamps. The green lamp indicates the printer is ready or in use. The orange lamp indicates low toner level. The first red lamp indicates the paper tray is empty or missing, and the second red lamp indicates a paper jam.

Now view Part 2, “Control System,” in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape. After watching the video, you should be able to locate the control system components and define their functions.

**Continue with Practice Exercise 3 on the next page.**



## Practice Exercise 3

### Directions

This exercise gives you the opportunity to locate LaserWriter II control system components.

**Warning:** The control system contains potentially dangerous voltage. To eliminate the risk of injury due to shock, disconnect the power cable from the LaserWriter II printer before beginning this exercise.

1. Using appropriate reference documents, practice locating each component from the list below until you can locate all components from memory.
2. Ask your service manager or a colleague to name each item in the list so you can point to it.
  - I/O PCB
  - DC controller PCB
  - Interlock switch and lever
  - Toner cartridge sensitivity switches SW301 and SW302
  - Status display

If you are unable to locate some parts, review Part 2, "Control System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape or the LaserWriter II "Parts" chapter of *Service Source*.

**When you are ready, complete Practice Exercise 4 on the next page.**

---

## Practice Exercise 4

**Directions**

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

- |  |  |
|--|--|
| ___ I/O PCB  | A. Contains the printer status lamps (green: ready/ in use, orange: low toner level, first red: paper out, and second red: paper jam). |
| ___ DC controller PCB                                    | B. Cuts off power to the printer when the upper unit opens.  |
| ___ Interlock switch and lever                           | C. Helps the DC controller match laser beam intensity to drum sensitivity.   |
| ___ Toner cartridge sensitivity switches SW301 and SW302 | D. The LaserWriter II “command center”— commands and monitors the other three printer systems.   |
| ___ Status display                                       | E. Controls communications between the printer and computers.  |

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



## Practice Exercise 4 (Answers)

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

- E. I/O PCB
- D. DC controller PCB
- B. Interlock switch and lever
- C. Toner cartridge sensitivity switches SW301 and SW302
- A. Status display

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

**When you are ready, begin the next section—"Image Formation System."**

# Image Formation System



## System Overview

This section covers the functions of the image formation system major components. Figure 1-9 illustrates the image formation system.

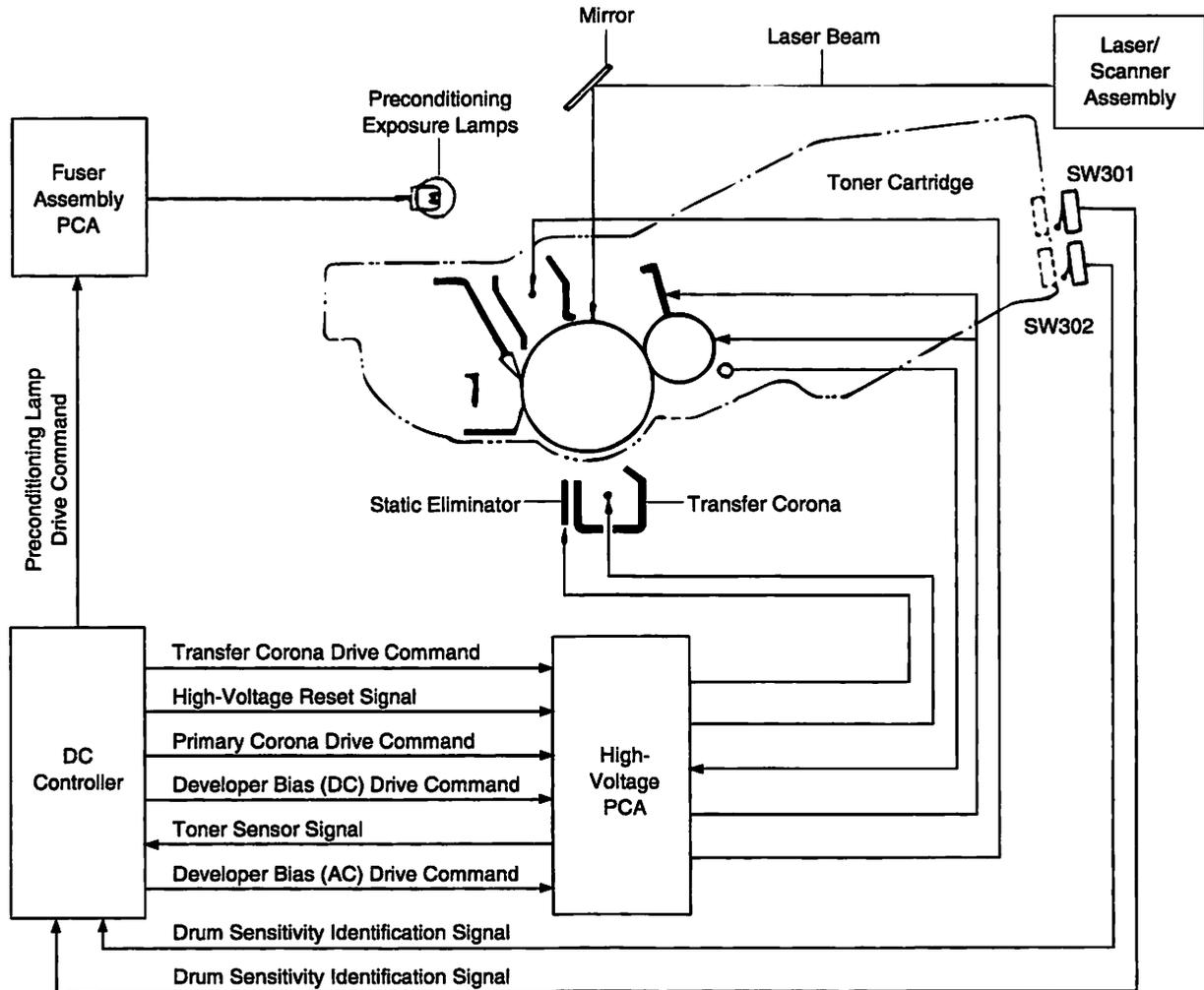


Figure 1-9  
LaserWriter II image formation system

## Component Functions

The image formation system has two major components: the laser/scanner assembly and the toner cartridge. The laser/scanner assembly generates the laser beam that reflects off the rotating hexagonal mirror to the mirror assembly and then onto the photosensitive drum. The laser/scanner assembly has the following major components:



## Image Formation System

- The fiber-optic cable, located on the laser/scanner assembly, carries the laser light signal that reflects from the beam-detect mirror to the DC controller PCB. The laser
- The laser beam blocking shutter, inside the laser/scanner assembly, closes when you open the upper unit. The shutter protects your eyes from the invisible infrared laser beam.
- The hexagonal mirror, located inside the laser/scanner assembly, produces the horizontal laser scan.
- The laser diode, located on the laser/scanner assembly, generates a stationary laser beam.

The toner cartridge houses the following components shown in Figure 1-10 on the next page:

- The photosensitive drum forms the print image and transfers it to paper.
- The primary corona applies a uniform layer of negative charge over the photosensitive drum.
- The light-blocking shutter #1 allows the preconditioning exposure lamp access to the photosensitive drum.
- The light-blocking shutter #2 allows the laser beam access to the photosensitive drum.
- The toner bin stores the toner.
- The developing cylinder applies toner from the toner bin to the photosensitive drum.

# Image Formation System

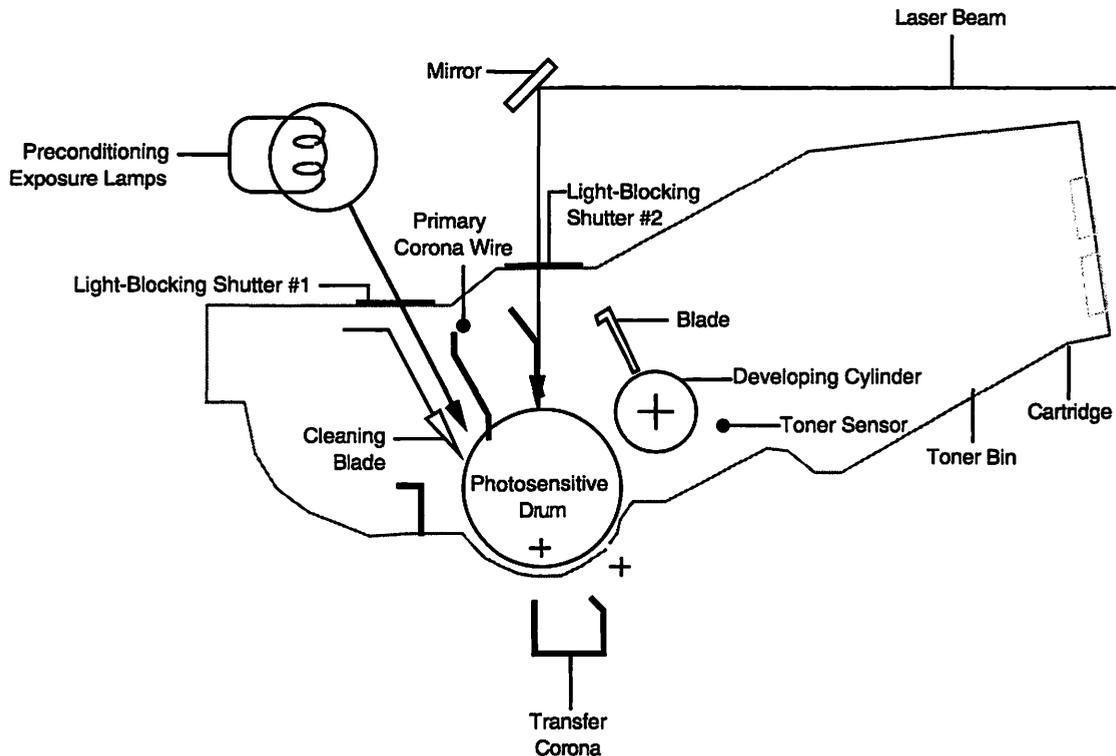


Figure 1-10  
The LaserWriter II image formation system

The following components, located near the toner cartridge, are also part of the image formation system (see Figure 1-10):

- The preconditioning exposure lamp, located on the upper unit directly above the toner cartridge, erases residual charges from the photosensitive drum.
- The mirror assembly reflects the laser beam from the hexagonal mirror (in the laser/scanner assembly) onto the photosensitive drum.
- The transfer corona wire puts a high positive charge on the paper, which causes the toner to transfer from the photosensitive drum to the paper.
- The power inputs on the toner cartridge contact the high-voltage power supply leads when the upper unit closes.

Now view Part 3, "Image Formation System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape. After watching the video, you should be able to locate the image formation system components and define their functions.

**Continue with Practice Exercise 5 on the next page.**



## Practice Exercise 5

### Directions

This exercise gives you the opportunity to locate LaserWriter II image formation system components.

**Warning:** The image formation system contains potentially dangerous voltage. To eliminate the risk of injury due to shock, disconnect the power cable from the LaserWriter II printer before beginning this exercise.

1. Using appropriate reference documents, practice locating each component from the list below until you can locate all components from memory.
2. Ask your service manager or a colleague to name each item in the list so you can point to it.
  - Laser/scanner assembly
  - Fiber-optic cable
  - Laser beam blocking shutter
  - Hexagonal mirror
  - Laser diode
  - Toner cartridge
    - Photosensitive drum
    - Primary corona
    - Light-blocking shutter #1
    - Light-blocking shutter #2
    - Toner bin
    - Developing cylinder
  - Preconditioning exposure lamp
  - Mirror assembly
  - Transfer corona
  - Power inputs for the primary corona

If you are unable to locate some parts, review Part 3, "Image Formation System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape or the LaserWriter II "Parts" chapter of *Service Source*.

**When you are ready, complete Practice Exercise 6 on the next page.**

## Practice Exercise 6

**Directions**

Match the image formation system components with their functions by writing the letter of the function in the space provided. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

- |   |  |
|---|--|
| ___ Laser/scanner assembly              | A. Container that stores toner.  |
| ___ Fiber-optic cable                   | B. Forms the print image and transfers it to paper.  |
| ___ Laser beam blocking shutter         | C. Generates the laser beam that reflects off the rotating hexagonal mirror, onto the mirror assembly and then onto the photosensitive drum.               |
| ___ Hexagonal mirror                    | D. Generates a stationary laser beam.  |
| ___ Laser diode                         | E. Allows the laser beam access to the photosensitive drum.  |
| ___ Photosensitive drum                 | F. Produces the horizontal laser scan.   |
| ___ Primary corona                      | G. Applies a uniform layer of negative charge over the photosensitive drum.  |
| ___ Light-blocking shutter #1           | H. Carries the laser light signal (reflected from the beam-detect mirror) to the DC controller PCB to indicate that the beam is about to start a new scan. |
| ___ Light-blocking shutter #2           | I. Applies toner from the toner bin to the drum.   |
| ___ Toner bin                           | J. Applies positive charges to the paper so that toner transfers from the photosensitive drum to the paper.  |
| ___ Developing cylinder                 | K. Erases residual charges from the photosensitive drum.   |
| ___ Preconditioning exposure lamp       | L. Allows the preconditioning exposure lamp access to the photosensitive drum.   |
| ___ Mirror assembly                     | M. Closes when you open the upper unit and protects your eyes from the invisible infrared laser beam.  |
| ___ Transfer corona                     | N. Reflects the laser beam from the laser/scanner assembly onto the photosensitive drum.   |
| ___ Power inputs for the primary corona | O. Makes contact with the leads on the high-voltage power supply when the upper unit closes.   |

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



## Practice Exercise 6 (Answers)

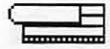
Compare your answers to Practice Exercise 6 with the answers below.

- C Laser/scanner assembly
- H Fiber-optic cable
- M Laser beam blocking shutter
- F Hexagonal mirror
- D Laser diode
- B Photosensitive drum
- G Primary corona
- L Light-blocking shutter #1
- E Light-blocking shutter #2
- A Toner bin
- I Developing cylinder
- K Preconditioning exposure lamp
- N Mirror assembly
- J Transfer corona
- O Power inputs for the primary corona

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

**When you are ready, begin the next section—"Pickup/Feed System."**

# Pickup/Feed System



## System Overview

This section presents the functions of the pickup/feed system components. Figure 1-11 illustrates the functional relationship of the pickup/feed system major components.

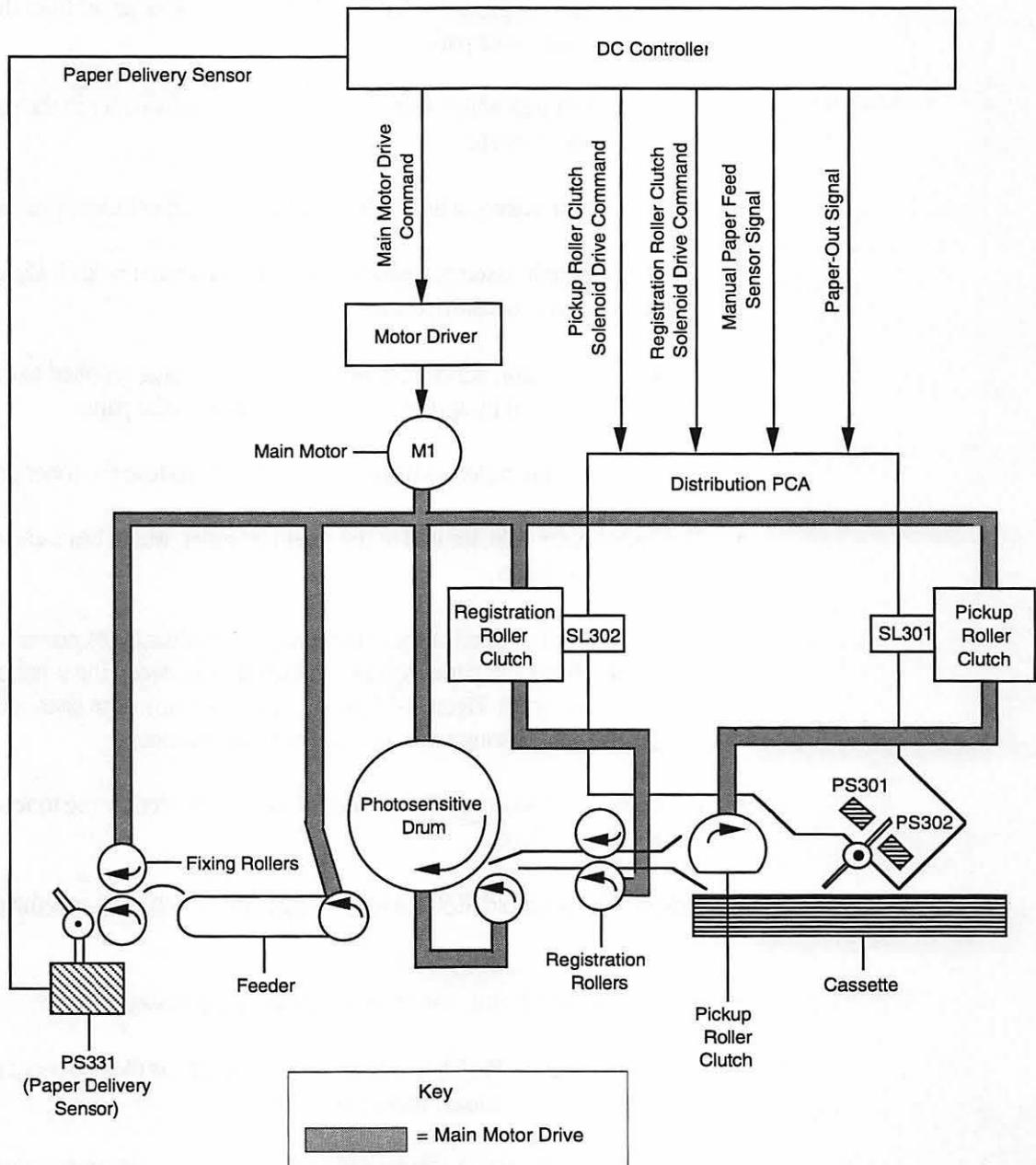


Figure 1-11  
The LaserWriter II pickup/feed system



## Pickup/Feed System

### Component Functions

The pickup/feed system has two main areas: the main motor drive and the distribution PCA. The main motor supplies power to the mechanical drive system—the gears and rollers that move paper through the printer. The motor powers the following parts:

- The paper cassette pickup roller, which moves sheets of paper from the paper cassette into the paper path.
- The separation pad, which helps separate the sheets of paper as the pickup roller feeds the paper forward.
- The registration rollers, which guide and align the paper before printing.
- The transfer guide assembly, which guides the paper and holds it aligned as it contacts the photosensitive drum.
- The static eliminator, which removes the positive charge (applied to the paper by the transfer corona) by applying a negative charge to the paper.
- The fuser pressure rollers, which provide pressure to fuse the toner onto the paper.
- The fuser heater bulb, located in the top fuser roller, which heats and melts the toner onto the paper.

The distribution PCA, located at the rear of the printer, distributes power to the solenoids that activate the paper rollers and interfaces between the toner cartridge and drum sensitivity switches. Figure 1-12 on the next page shows the distribution PCA which includes the following solenoids, sensors, and switches:

- Drum sensitivity switches SW301 and SW302, which identify the toner cartridge drum-sensitivity level.
- Pickup roller solenoid SL301, which engages the clutch and turns the paper pickup roller.
- Paper out sensor PS301, which senses paper in the cassette.
- Manual feed sensor PS302, which uses the same arm as the paper-out sensor and senses paper that manually feeds into the printer.
- Registration roller clutch solenoid SL302, which rotates the registration rollers and feeds paper toward the photosensitive drum.

## Pickup/Feed System

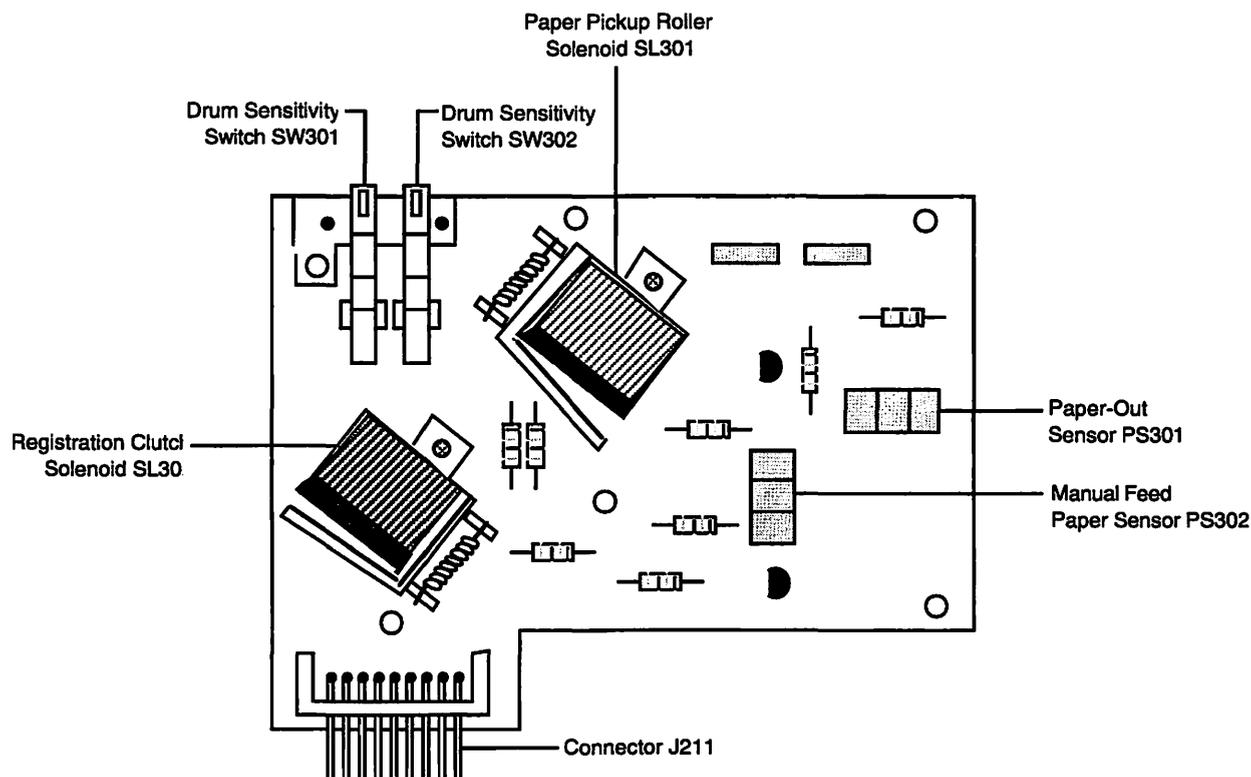


Figure 1-12  
The LaserWriter II distribution PCA

The final major component of the pickup/feed system is the paper delivery sensor PS331. The sensor is located on the fuser PCA or fuser assembly PCA and senses the delivery of paper. If paper fails to reach and clear the sensor within the necessary time, a paper jam occurs.

Now view Part 4, "Pickup/Feed System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape. After watching the video, you should be able to locate the pickup/feed system components and define their functions.

**Continue with Practice Exercise 7 on the next page.**



## Practice Exercise 7

### Directions

This exercise gives you the opportunity to locate LaserWriter II pickup/feed system components. **Caution:** The pickup/feed system contains potentially dangerous voltage. To eliminate the risk of injury due to shock, disconnect the power cable from the LaserWriter II printer before beginning this exercise.

1. Using appropriate reference documents, practice locating each component from the list below until you can locate all components from memory.
2. Ask your service manager or a colleague to name each item in the list so you can point to it.
  - Main motor
  - Paper cassette pickup roller
  - Separation pad
  - Registration rollers
  - Transfer guide assembly
  - Static eliminator
  - Fuser pressure rollers
  - Fuser heater bulb
  - Distribution PCA
  - Pickup roller solenoid SL301
  - Paper-out sensor PS301
  - Manual feed sensor PS302
  - Registration roller clutch solenoid SL302
  - Paper delivery sensor PS331 (on the fuser assembly)
  - Drum sensitivity switches SW301 and SW302

If you are unable to locate some parts, review Part 4, "Pickup/Feed System," in the first section (Parts and Functions) of the *LaserWriter II Service Training* videotape or the LaserWriter II "Parts" chapter of *Service Source*.

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

## Practice Exercise 8



### Directions

Match the pickup/feed system components with their functions by writing the letter of the function in the space provided. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

- |   |   |
|---|---|
| — Main motor                                | A. Removes the charge the transfer corona applies to the paper.   |
| — Paper cassette pickup roller              | B. Contains two solenoids and two sensors.  |
| — Separation pad                            | C. Senses paper that manually feeds into the printer.   |
| — Registration rollers                      | D. Engages the clutch and turns the paper pickup roller.  |
| — Transfer guide assembly                   | E. Senses paper in the cassette.  |
| — Static eliminator                         | F. Rotates the registration rollers and feeds paper toward the photosensitive drum.   |
| — Fuser pressure rollers                    | G. Moves sheets of paper from the paper cassette into the paper path.   |
| — Fuser heater bulb                         | H. Helps separate sheets of paper as the pickup roller feeds the paper forward.   |
| — Distribution PCA                          | I. Guides and aligns the paper before the print process begins.   |
| — Pickup roller solenoid SL301              | J. Guides the paper and holds it aligned as it contacts the photosensitive drum.  |
| — Paper-out sensor PS301                    | K. Provides pressure to fuse the toner onto the paper.  |
| — Manual feed sensor PS302                  | L. Identify the toner cartridge drum-sensitivity level.   |
| — Registration roller clutch solenoid SL302 | M. Senses the delivery of paper. If the paper fails to reach and clear this sensor within the necessary time, a paper jam occurs. |
| — Paper delivery sensor PS331               | N. Provides and controls the heat that melts toner onto the paper.  |
| — Drum sensitivity switches                 | O. Powers the mechanical drive system.  |

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



## Practice Exercise 8 (Answers)

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

- ~~Q~~ Main motor
- ~~G~~ Paper cassette pickup roller
- ~~H~~ Separation pad
- ~~I~~ Registration rollers
- ~~J~~ Transfer guide assembly
- ~~A~~ Static eliminator
- ~~K~~ Fuser pressure rollers
- ~~N~~ Fuser heater bulb
- ~~B~~ Distribution PCA
- ~~D~~ Pickup roller solenoid SL301
- ~~E~~ Paper-out sensor PS301
- ~~C~~ Manual feed sensor PS302
- ~~F~~ Registration roller clutch solenoid SL302
- ~~M~~ Paper delivery sensor PS331
- ~~L~~ Drum sensitivity switches

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

**When you are ready, begin the next section—"Operational Sequence."**

# Operational Sequence



This section covers the operational sequence of the LaserWriter II printer. Problems with the printer frequently involve more than one system (control system, image formation system, etc.). This section shows the relationship of parts and functions and builds on what you learned about LaserWriter theory of operation in the *Introduction to Laser Printer Service* course. We present troubleshooting "Tech Tips" at most stages of the operational sequence. Refer to the wiring diagram in Appendix A of this booklet throughout this section.

## Print Command

A computer sends two types of commands to the printer DC controller via the I/O board: status request commands and executable commands. A status request command asks the printer to send status. An executable command tells the printer to perform an action. Figure 1-13 shows the communication path between the computer and printer and also shows several actions the DC controller performs.

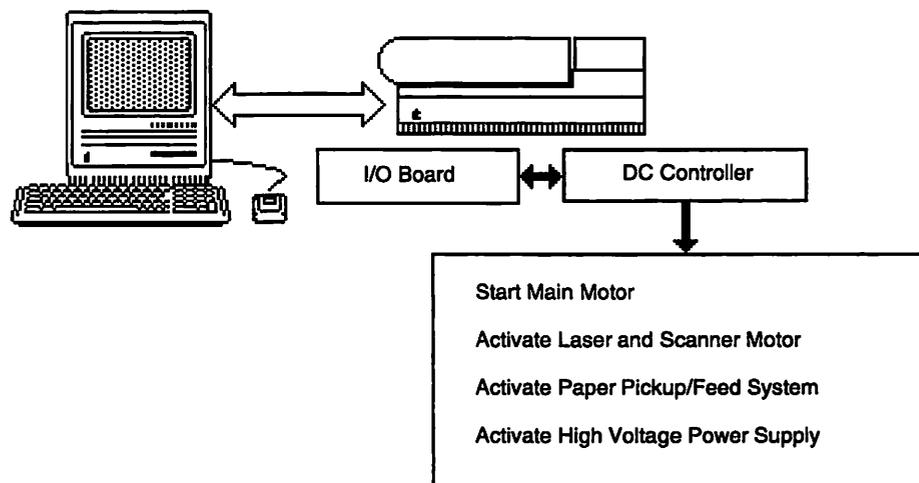


Figure 1-13  
The communication path between computer and printer

## User Test Page

The user test page prints at power-up when the ROMs send commands to the print engine.

## Tech Tip!

If the user test page fails, first check that a toner cartridge is installed. If the page still does not print, the problem could be the LaserWriter II print engine or I/O PCB. The service test page tests the print engine. If the printer produces a service test page, the print engine is fine and the problem could be the I/O PCB.



## Operational Sequence

### Status Panel

The DC controller activates the status panel after receiving instructions from the I/O board. The status panel lights act differently depending on the type of LaserWriter II controller board. Each of the five controller boards (LaserWriter IISC, IINT, IINTX, IIf, and IIg) produces different displays. Refer to the appropriate volume of the *Apple Service Guides for LaserWriter Printers* or to *Service Source* for more information.

### Tech Tip!

The DC controller continuously samples the paper-out sensor PS301 when the printer is not actually printing. If PS301 fails, the DC controller thinks there is no paper and lights the solid red Paper-Out LED. When paper fails to reach and clear the paper delivery sensor PS331 within the necessary time, the DC controller sends a signal to light the red Paper Jam LED.

Be aware of problem indicators with the status panel LEDs. The following examples could indicate LEDs with faulty electronic circuits or LED lamps:

- The printer works fine, but the green Ready/In Use LED never lights.
- You force a paper jam but the red Paper Jam LED doesn't light.
- You take paper out of the cassette but the red Paper-Out LED doesn't light.

### Main Motor

When the DC controller receives a print command from the computer, the computer sends a signal via J212 (see Appendix A wiring diagram) to the DC power supply/main motor. The main motor (M1 on the wiring diagram) activates and rotates the photosensitive drum and developing cylinder in the toner cartridge.

### Tech Tip!

If the main motor jams or binds, it draws a lot of electrical current. The current flows from the power input to the main motor through the DC power supply. Because excessive current can blow the power supply, electricity to the main motor goes through the main motor fuse. The fuse opens if the electrical current drain is too great. After you determine the cause of the current overload, you may have to replace the main motor fuse.

Power travels from the power input to the fan through circuit breaker CB1. CB1 protects the DC power supply and motor drive PCA electronics in the event of a power problem. If CB1 trips, the power turns off at that point in the power path.

# Operational Sequence

**Scanning Motor**

The DC controller activates the scanning motor (M3) via J203. The scanner driver keeps the speed of the motor constant and rotates the hexagonal mirror, which reflects the image onto the photosensitive drum.

**Pickup/Registration Rollers**

The DC controller signals the driver/sensor PCA via J213 to activate the pickup roller solenoid SL301. The main motor activates the pickup roller clutch to engage and turn the paper pickup roller one rotation. The paper pickup roller feeds the paper to the registration rollers. The registration rollers do not turn when the paper reaches them, so the paper arches to align with the rollers. When the registration roller clutch solenoid activates, the roller feeds the paper so that the leading edge of the paper aligns with the leading edge of the image on the photosensitive drum.

**Tech Tip!**

When you print, you can hear the printer pick up the paper from the paper cassette. If nothing happens after that, open the printer and check to see that the paper is properly positioned. If the paper position is normal, the registration roller clutch solenoid SL302 may have failed.

**Paper Delivery Sensor**

The paper delivery sensor PS331 senses delivery of the paper. The sensor tells the DC controller that the paper has left the printer. When the DC controller receives the message that the paper has reached the transfer guide assembly, the main motor turns the drum and powers the rollers at the right speed to bring the paper into contact with the drum, and ultimately out of the printer through the fuser assembly.

**Tech Tip!**

The DC controller generates a paper jam signal and lights the red Paper Jam LED when

- It does not receive a signal from the paper delivery sensor PS331 within the required time
- The paper does not clear the delivery sensor within the required time
- Paper is present at the sensor when power is switched on
- The paper delivery sensor PS331 fails

**High-Voltage Power Supply**

The DC controller sends a signal to the high-voltage power supply through connector J211 to provide high-voltage power to the primary corona and transfer corona. The high-voltage power supply also supplies the toner cartridge developing cylinder with AC and DC bias voltages, amplifies the toner sensor signal, and feeds the amplified signal back to the DC controller when the toner supply is inadequate.



## Operational Sequence

### Tech Tip!

If you get a black print, check the high-voltage power supply. If the supply fails and affects power to the primary corona, the primary corona will fail. If the primary corona doesn't apply enough negative base charge to the drum surface, the base charge will be too positive. The negatively charged toner particles in the developer attract to all areas on the drum, both those that were exposed to the laser and those that were not, resulting in a black print.

### Preconditioning Exposure Lamp

The preconditioning lamp exposes the drum and prepares it to receive a uniform charge.

### Tech Tip!

If the preconditioning exposure lamp fails to erase the charges of an old print from the surface of the drum, the old images will remain and will appear as "ghosts" on the page.

### Drum Sensitivity Switches

Drum sensitivity identification cams in the toner cartridge provide feedback to the DC controller via two switches (SW301 and SW302). The DC controller adjusts the laser beam intensity to match the drum sensitivity.

### Tech Tip!

If the print image is too dark with some toner cartridges, but OK with others, one of the sensitivity microswitches has failed. The drum sensitivity varies from cartridge to cartridge and is determined by the number of cams. Each cartridge has a place for two cams—some cartridges have both cams, while others only have one. When you insert the cartridge, the cams trip the sensitivity microswitches. If one of the microswitches fails, the printer cannot detect drum sensitivity and develops printing problems. If both switches fail, or if both cams are missing, the printer thinks a toner cartridge is not installed. To solve this problem, replace the toner cartridge or the distribution PCA (which holds the microswitches).

### Primary Corona

The primary corona applies a uniform layer of negative charges over the drum surface.

### Tech Tip!

If the primary corona doesn't apply enough negative base charge to the drum surface, the toner particles will attract to all areas of the drum (exposed and unexposed), resulting in a black print. Dirt on the primary corona also lessens the charge on the photosensitive drum, resulting in a gray background. Clean the primary corona whenever you service a LaserWriter II printer. If a consistent spider web pattern appears in the same spot on all prints, the drum surface may be scratched. Wherever the surface of the drum is scratched, the base charge will not be uniform, resulting in poor quality prints.

# Operational Sequence

**Laser Beam**

The laser beam scans the drum surface and neutralizes the charge in areas where the beam strikes. The charges left on the drum form an invisible pattern, or the electrostatic latent image.

**Tech Tip!**

Toner adheres to the drum only where the laser strikes the surface. If light-blocking shutter #2 is closed, the laser cannot access the drum, resulting in a blank image.

**Developing Cylinder**

The electrostatic latent image on the drum surface converts into a visible image of toner particles. The areas on the drum that were exposed to the laser beam have a higher potential (are less negative) than the negatively charged toner particles on the developing cylinder. When these areas approach the cylinder, the potential difference causes the toner particles to jump to the drum. This process is called toner projection development. The developing cylinder receives an AC bias to assist the toner particles in jumping to the drum surface. The blade also receives the bias to keep the blade and cylinder at the same potential and to prevent irregular movement of toner between them. Turning the print-density adjustment dial changes the DC bias and the potential difference between the developing cylinder and photosensitive drum, which changes the print density.

**Transfer Corona**

The transfer corona applies a positive charge to the back of the paper, which attracts the negatively charged particles of the toner image and causes them to transfer from the drum surface onto the paper. The paper separates from the drum when the static-charge eliminator emits negative voltage that weakens the attractive force between the paper and the drum. The voltage prevents thin paper from wrapping around the drum.

Once the toner image transfers to the paper, it is held in place by electrostatic attraction and slight physical adhesion. Heat and pressure then fuse the toner particles onto the paper to make a permanent image. A cleaning blade removes the toner that remains on the photosensitive drum so the next print image will be clear and distinct.



## Operational Sequence

### LaserWriter IIf and IIg Operational Overview

To effectively troubleshoot the LaserWriter IIf and IIg printers, you should understand two unique technologies: FinePrint and PhotoGrade. This section describes how FinePrint and PhotoGrade improve the 300 dpi LaserWriter II print engine performance. This section may also help you explain these new technologies to users.

#### FinePrint

FinePrint uses high-definition, print-quality enhancements provided by two ASICs (application-specific integrated circuits) that pulse the laser more rapidly than previously possible. The high-definition ASICs improve text and line-art prints by

- Mapping the black/white transitions (or edge) formed on the page by text or line-art
- Calculating the ideal edge of the text or line-art
- Pulsing the laser to simulate the ideal edge of the text or line-art

Figure 1-14 shows the three-step FinePrint calculation and print process. The ASICs pulse the laser up to 4800 dpi in the horizontal direction, so images are extremely crisp and smooth.

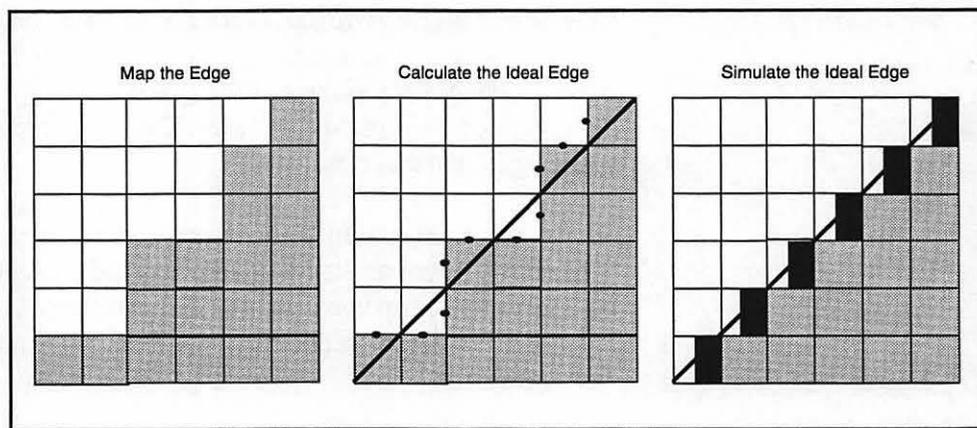
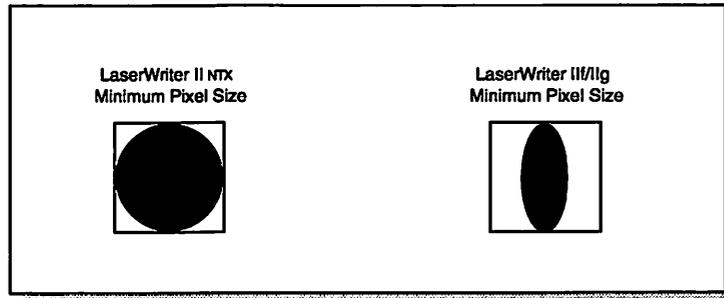


Figure 1-14  
The FinePrint calculation

The pulse technique allows greater control over the amount of toner the printer places within a 300 dpi pixel. The technique produces thinner pixels, and the more defined pixels make the printed edges look smoother. Figure 1-15 on the next page shows the pixel sizes of different LaserWriter printers.

# Operational Sequence

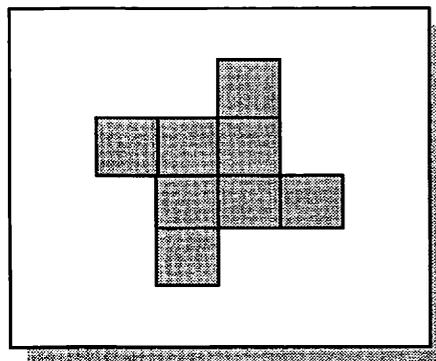


**Figure 1-15**  
LaserWriter II NTX vs. LaserWriter IIg minimal pixel size

## PhotoGrade

The high-definition ASICs also allow the LaserWriter IIg printer to produce more gray levels than the LaserWriter II NTX. The additional gray levels, or PhotoGrade, allow the LaserWriter IIg to print near-photographic-quality images.

Grayscale images are produced by repeating a pattern of pixels called a screen or halftone cell, as shown in Figure 1-16. The level of gray depends on the number of pixels that are in the cell. As the number of pixels increases, the gray level increases and the image gets darker.



**Figure 1-16**  
A LaserWriter II halftone cell



# Operational Sequence

The LaserWriter IIg laser pulse duration varies the pixel size, which increases the halftone cell variations and the amount of possible gray levels. Figure 1-17 compares the LaserWriter IIINTX and LaserWriter IIg halftone cells.

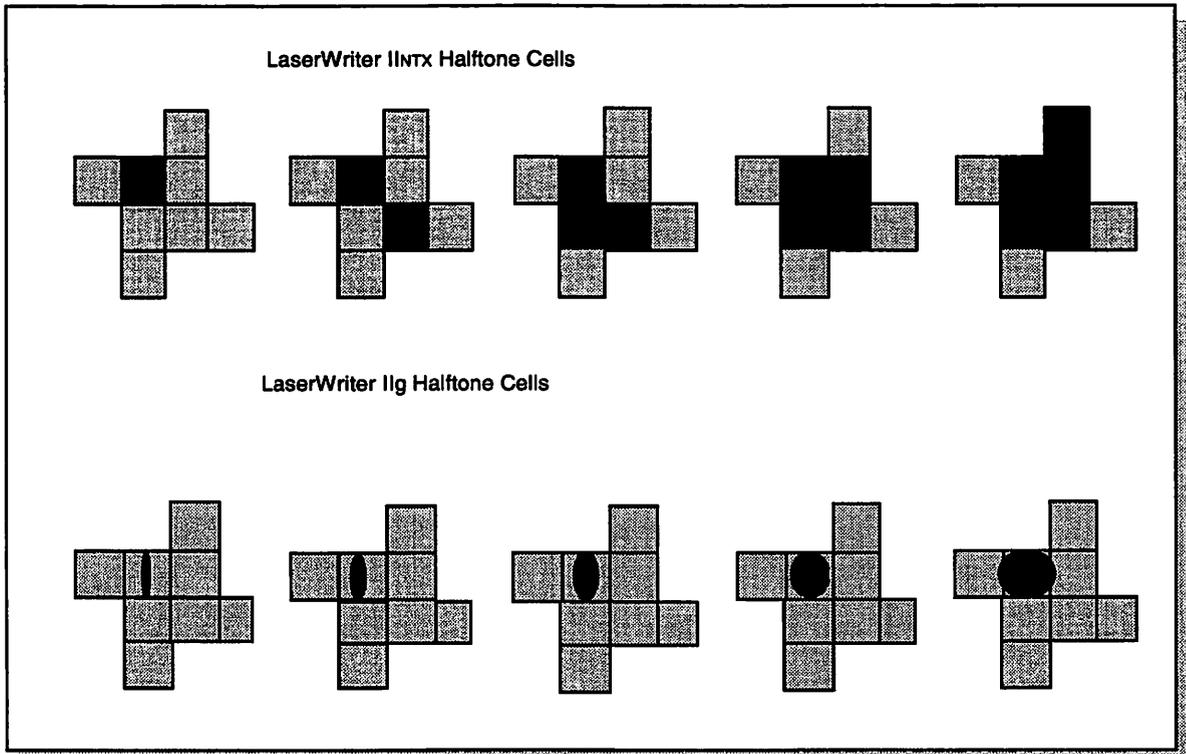


Figure 1-17  
LaserWriter IIINTX vs. LaserWriter IIg halftone cells

Continue with Practice Exercise 9 on the next page.

---

## Practice Exercise 9

**Directions**

Match each LaserWriter II problem with its probable cause. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

- A. The primary corona is dirty.
  - B. Cartridge sensitivity microswitch MS301 or MS302 failed.
  - C. Circuit breaker CB1 tripped.
  - D. The fan failed.
  - E. A fuse on the DC power supply PCA blew.
- 
- 1. You switch on the printer but nothing happens. The fan doesn't come on.
  
  - 2. You switch on the printer. The fan does not come on, but the user test page prints as expected. Everything seems to work fine.
  
  - 3. The user switched on the printer and heard a groaning sound; then the printer quit. You look inside the printer and find a stray piece of paper jammed in the main drive gear. You remove the paper and switch on the printer but nothing happens.
  
  - 4. The print image is too dark with some cartridges but OK with others. All the cartridges work fine in another LaserWriter II printer.
  
  - 5. The print image is the right intensity, but the background is gray.

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



## Practice Exercise 9 (Answers)

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

- C 1. You switch on the printer but nothing happens. The fan doesn't come on.

**Explanation:** Power travels from the power input to the fan through circuit breaker CB1. CB1 protects the DC power supply and motor drive PCA electronics in the event of a power problem. If CB1 trips, power does not reach the fan.

- D 2. You switch on the printer. The fan does not come on, but the user test page prints as expected. Everything seems to work fine.

**Explanation:** If everything else works fine, the problem must be the fan.

- E 3. The user switched on the printer and heard a groaning sound; then the printer quit. You look inside the printer and find a stray piece of paper jammed in the main drive gear. You remove the paper and switch on the printer but nothing happens.

**Explanation:** If the main motor jams or binds, it draws a lot of current. The current flows from the power input to the main motor through the DC power supply and motor drive PCA. Excessive current can destroy the assembly. To protect the motor drive PCA, electricity goes to the main motor through the main motor fuse, which opens if the electrical current drain is too great.

- B 4. The print image is too dark with some cartridges but OK with others. All the cartridges work fine in another LaserWriter II printer.

**Explanation:** The photosensitive drum surface in a toner cartridge varies from cartridge to cartridge and is determined by the number of cams. Some cartridges have one cam; others have two. The cams trip the sensitivity microswitches when you insert a cartridge. If one of the microswitches fails, the printer cannot detect drum sensitivity and will have print problems.

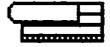
- A 5. The print image is the right intensity but the background is gray.

**Explanation:** Dirt on the primary corona can lessen the effect of the charges on the photosensitive drum, resulting in a gray background.

**When you are ready, begin the module test.**

---

# Module Test



You should have been able to correctly answer at least 80 percent of the practice exercise questions. If you need to, review the practice exercises and the entire first section (Parts and Functions) of the *LaserWriter II Service Training* videotape before taking the module test.

The module test consists of two sections:

Section A: Ask your service manager or a colleague to read the names of LaserWriter II subsystem components and check to see that you point to each of them correctly.

Section B: You will match LaserWriter II subsystem components with their functions.

**When you are ready, go on to Section A of the test on the next page.**



## Module Test—Section A

Set up a LaserWriter II with the panels removed. Then ask your service manager or a colleague to read the names of LaserWriter II subsystem components and check to see that you point to them correctly.

### Power Distribution System

1. Power supply block
2. Upper fan
3. Lower fan
4. DC power supply
5. High-voltage power supply

### Control System

1. I/O PCB
2. DC controller PCB
3. Interlock switch and lever
4. Toner cartridge sensitivity switches SW301 and SW302
5. Status display

### Image Formation System

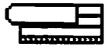
- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Laser/scanner assembly</li> <li>2. Fiber-optic cable</li> <li>3. Laser beam blocking shutter</li> <li>4. Hexagonal mirror</li> <li>5. Laser diode</li> <li>6. Photosensitive drum</li> <li>7. Primary corona</li> <li>8. Light-blocking shutter #1</li> <li>9. Light-blocking shutter #2</li> </ol> | <ol style="list-style-type: none"> <li>10. Toner bin</li> <li>11. Developing cylinder</li> <li>12. Preconditioning exposure lamp</li> <li>13. Mirror assembly</li> <li>14. Power inputs for the primary corona</li> <li>15. Transfer corona</li> </ol> |
|---|--|

### Pickup/Feed System

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Main motor</li> <li>2. Paper cassette pickup roller</li> <li>3. Separation pad</li> <li>4. Registration rollers</li> <li>5. Transfer guide assembly</li> <li>6. Static eliminator</li> <li>7. Fuser pressure rollers</li> <li>8. Fuser heater bulb</li> <li>9. Distribution PCA</li> </ol> | <ol style="list-style-type: none"> <li>10. Pickup roller solenoid SL301</li> <li>11. Paper-out sensor PS301</li> <li>12. Manual feed sensor PS302</li> <li>13. Registration roller clutch solenoid SL302</li> <li>14. Paper delivery sensor PS331</li> <li>15. Drum sensitivity switches SW301 and SW302</li> </ol> |
|--|---|

**When you successfully complete Section A, go on to Section B—Part 1 on the next page.**

# Module Test—Section B



## Part 1 Directions

Match the power distribution and control system components with their functions by writing the function in the space provided. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

- |  |   |
|--|---|
| _____ Power supply block                                   | A. Supplies power to the main motor and DC controller PCB.  |
| _____ DC power supply                                      | B. Contains the main power switch, circuit breaker, AC driver PCA, and fuser safety PCA.  |
| _____ High-voltage power supply                            | C. Provides power to the primary corona and transfer corona.  |
| _____ I/O PCB  | D. Cuts off power to the printer when the upper unit opens.   |
| _____ DC controller PCB                                    | E. Contains the printer status lamps (green: ready/in use, orange: low toner level, first red: paper out, second red: paper jam). |
| _____ Interlock switch and lever                           | F. Controls communications between the printer and computers.   |
| _____ Toner cartridge sensitivity switches SW301 and SW302 | G. Helps the DC controller match laser beam intensity to drum sensitivity.  |
| _____ Status display                                       | H. The LaserWriter II “command center”—controls and monitors the other three printer systems.                                     |

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



## Module Test—Section B (Answers)

### Part 1 Answers

- \_\_\_B\_\_\_ Power supply block—Contains the main power switch, circuit breaker, AC Driver PCA, and fuser PCA.
- \_\_\_A\_\_\_ DC power supply—Supplies power to the main motor and DC Controller PCA.
- \_\_\_C\_\_\_ High-voltage power supply—Provides power to the primary corona and transfer corona.
- \_\_\_F\_\_\_ I/O PCB—Controls communications between the printer and computers.
- \_\_\_H\_\_\_ DC controller PCB—The LaserWriter II "command center"—controls and monitors the other three printer systems.
- \_\_\_D\_\_\_ Interlock switch and lever—Cuts off power to the printer when the upper unit opens.
- \_\_\_G\_\_\_ Toner cartridge sensitivity switches SW301 and SW302—Helps the DC controller match laser beam intensity to drum sensitivity.
- \_\_\_E\_\_\_ Status display—Contains the printer status lamps (green: ready/in use; orange: low toner level; first red: paper out; second red: paper jam).

**If you answered fewer than 7 items correctly, go back and review the the power distribution and control system components before you go on to Section B—Part 2 of the module test, on the next page.**

# Module Test—Section B



## Part 2 Directions

Match the image formation and pickup/feed system components with their functions list by writing the letter of the function in the space provided. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

- |                                     |  |
|-------------------------------------|--|
| _____ Laser/scanner assembly        | A. Forms the print image and transfers it to paper.  |
| _____ Fiber-optic cable             | B. Generates the laser beam that reflects off the rotating hexagonal mirror onto the mirror assembly and then onto the photosensitive drum.                |
| _____ Hexagonal mirror              | C. Produces the horizontal laser scan.   |
| _____ Photosensitive drum           | D. Applies a uniform layer of negative charge over the photosensitive drum.  |
| _____ Primary corona                | E. Carries the laser light signal (reflected from the beam-detect mirror) to the DC controller PCA to indicate that the beam is about to start a new scan. |
| _____ Developing cylinder           | F. Applies toner from the toner bin to the drum  |
| _____ Preconditioning exposure lamp | G. Applies positive charges to the paper and causes toner to transfer from the photosensitive drum to the paper.   |
| _____ Transfer corona               | H. Erases residual charges from the photosensitive drum.   |
| _____ Main motor                    | I. Removes the charge the transfer corona applies to the paper.  |
| _____ Paper cassette pickup roller  | J. Moves sheets of paper from the paper cassette into the paper path.  |
| _____ Transfer guide assembly       | K. Provides power for all the mechanical drive in the printer.   |
| _____ Static eliminator             | L. Guides the paper and holds it aligned as it contacts the photosensitive drum.   |
| _____ Fuser pressure rollers        | M. Provides pressure to fuse toner onto the paper.   |
| _____ Fuser heater bulb             | N. Controls the heat that melts the toner onto the paper.  |

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



## Module Test—Section B (Answers)

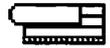
### Part 2 Answers

- B— Laser/scanner assembly—Generates the laser beam that reflects off the rotating hexagonal mirror onto the mirror assembly and then onto the photosensitive drum.
- E— Fiber-optic cable—Carries the laser light signal (reflected from the beam-detect mirror) to the DC controller PCA to indicate that the beam is about to start a new scan.
- C— Hexagonal mirror—Produces the horizontal laser scan.
- A— Photosensitive drum—Forms the print image and transfers it to the paper.
- D— Primary corona—Applies a uniform layer of negative charge over the photosensitive drum.
- F— Developing cylinder—Applies toner from the toner bin to the drum.
- H— Preconditioning exposure lamp—Erases residual charges from the photosensitive drum.
- G— Transfer corona—Applies positive charges to the paper and causes toner to transfer from the photosensitive drum to the paper.
- K— Main motor—Provides power for all the mechanical drive in the printer.
- J— Paper cassette pickup roller—Moves sheets of paper from the paper cassette into the paper path.
- L— Transfer guide assembly—Guides the paper and holds it aligned as it contacts the photosensitive drum.
- I— Static eliminator—Removes the charge the transfer corona
- M— applies to the paper.
- N— Fuser pressure rollers—Provides pressure to fuse toner onto the paper.  
Fuser heater bulb—Controls the heat that melts the toner onto the paper.

**If you answered fewer than 12 items correctly, go back and review the image formation and pickup/feed system components before going on to the next module—“LaserWriter II Take-Apart.”**

---

# Overview



This module gives you an opportunity to take apart and reassemble the LaserWriter II printer and to remove and replace the components that will most likely need service. Taking apart the LaserWriter II printer also gives you an opportunity to more closely examine the components presented in the “LaserWriter II Parts and Functions” module you just completed.

**Objective**

After completing this module, you will be able to take apart and reassemble the LaserWriter II printer using *Service Source* and the *LaserWriter II Service Training* videotape and without damaging any printer parts.

**Required Materials**

This module requires the following materials and equipment:

- LaserWriter II printer
- Phillips #2 screwdrivers — small, medium, and long (magnetized)
- Small flat-blade screwdriver
- Grounded ESD workstation
- *LaserWriter II Service Training* videotape, second section (Take-Apart)
- *Apple Service Source*

**Module Organization**

This module has one section, “Take-Apart Instructions,” which guides you through taking apart and reassembling a LaserWriter II printer. Follow the instructions on the following pages to view the second section (Take-Apart) of the *LaserWriter II Service Training* videotape and refer to *Service Source*. Be sure to remove and replace the components in the sequence listed in the instructions.

**Module Test**

You will meet the module objectives when you can reassemble the LaserWriter II printer without damaging any parts and print a user test page.



## Take-Apart Instructions

This section lets you practice disassembly and reassembly at your own speed until you are confident you can replace any LaserWriter II printer component with skill and efficiency.

The steps below list the tasks you will perform. Watch the first take-apart demonstration on the *LaserWriter II Service Training* videotape. Then, follow the procedures in the "Take Apart" chapter of the LaserWriter II manual in *Service Source* and practice each task until you can confidently perform all procedures. You may watch two take-apart demonstrations on the videotape before removing or replacing a component.

**Important:** Some steps tell you to both remove and replace a printer part, while others only direct you to remove the part. Some later steps are easier if certain parts have already been removed. To save yourself time and trouble, follow the steps exactly as written. Be sure to wear your ESD wriststrap. As you take apart your LaserWriter II printer, remember the location of each screw you remove. If you replace a black screw with a silver screw, you will reduce grounding and cause premature component failure.

Perform the following take-apart tasks:

1. Remove the paper cassette and toner cartridge.
2. Remove the LaserWriter II I/O PCB.
3. Remove the cover set.
4. Remove the upper fan.
5. Remove the fuser assembly.
6. Remove the power supply block.
7. Remove the laser/scanner assembly.
8. Remove the DC power supply.
9. Remove the main motor assembly.
10. Remove the high-voltage power supply.
11. Remove the transfer guide assembly.

# Take-Apart Instructions



Watch the videotape from the section “Replace the Heater Bulb” to the end of “Replace the Upper Fan.”

12. Replace the high-voltage power supply.
13. Replace the transfer guide assembly.
14. Replace the main motor assembly.
15. Replace the DC power supply.
16. Replace the laser/scanner assembly.
17. Replace the power supply block.
18. Replace the fuser assembly.
19. Replace the upper fan.
20. Replace the toner cartridge and paper cassette.
21. Print a service test page (The status display panel LEDs will not light without the I/O PCB installed.)

Watch the videotape from the section “Remove the Bottom Panel and Lower Cover” through the end of the videotape.

22. Remove the toner cartridge and paper cassette.
23. Remove the bottom panel and lower cover.
24. Remove the DC controller PCB.
25. Replace the DC controller PCB.
26. Replace the lower cover and bottom panel.
27. Replace the cover set.
28. Replace the LaserWriter II I/O PCB.



## Take-Apart Instructions

29. Replace the paper cassette and toner cartridge.
30. Print a user test page.

Practice the procedures until you are confident you can perform them easily and correctly. When you finish with step 30, ask your service manager or a colleague to verify that you properly reassembled the LaserWriter II printer.

**When you are ready, begin the next module —“LaserWriter II 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 II. In this module, the term “LaserWriter II printer” refers to the LaserWriter IISC, IINT, IINTX, IIc, and IIg, except where otherwise noted.

## Objectives

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

1. Indicate troubleshooting steps when given Apple service reference materials and a description of a LaserWriter II failure.
2. Return a printer to functional condition, when given Apple service reference materials and a faulty LaserWriter II printer.

## Required Materials

This module requires the following reference materials:

- *Apple Service Source* CD, version 2.0 (February 1996 or later)
- *Apple Service Guides for LaserWriter Printers* (information on the LaserWriter II family of printers is in *Volume I*)

## Module Organization

This module includes five sections:

- “Overview” provides an overview of this module.
- “Hands-On Troubleshooting” reviews the hands-on troubleshooting process and when to use the service resources.
- “Module Test—Part 1” is the multiple-choice portion of the module test.
- “Hands-On Troubleshooting Practice” provides directions for completing the hands-on troubleshooting practice exercise.
- “Module Test—Part 2” provides directions for completing the second part of the module test.

## Module Test

The module test has two parts: Part 1 consists of multiple-choice questions that you should be able to answer with at least 80 percent accuracy; Part 2 directs you to troubleshoot and repair two faulty LaserWriter II printers.



# Hands-On Troubleshooting

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

## Troubleshooting Process

Perform hands-on troubleshooting when

- You cannot resolve the customer's laser printer problem over the telephone and you need to replace a component 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.

## 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.

## 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 the next section of this module. Use the service resources to guide you through the most effective and efficient sequence of hands-on troubleshooting actions. 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.

## Verify Problem Resolution

After you identify and replace a faulty part, you must thoroughly test the laser printer to verify the problem resolution. Testing a repair 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

# Hands-On Troubleshooting



customer.

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

## Service Resources

Three service resources are available to help you perform LaserWriter II hands-on troubleshooting:

- *Apple Service Source* CD, version 2.0 (February 1996 or later)
- *Apple Service Guides for LaserWriter Printers* (information on the LaserWriter II family of printers is in *Volume I*)
- LaserWriter II Test Connector

## 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 with the *Apple Service Source* CD.

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 any **LaserWriter II** model from the printer product list that appears. You are now in the LaserWriter II manual of *Apple Service Source*. The LaserWriter II manual covers LaserWriter models IISC, IINT, IINTX, II, and IIg. (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 II manual window to go to the **Flowcharts** section in the “Troubleshooting” chapter. The **Flowcharts** will usually be the most useful section to you when troubleshooting.

“LaserWriter II Flowcharts” is an interactive file that guides you through a comprehensive check of the LaserWriter II. 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 II manual on *Apple Service Source*, stop and do so now. You will use *Service Source* to complete the practice exercises and



# Hands-On Troubleshooting

test later in this module. To successfully complete the module test, you must accurately follow the troubleshooting procedures on *Service Source*.

## Apple Service Guide

The *Apple Service Guides for LaserWriter Printers* provide a subset of the most frequently used procedures and information on *Apple Service Source* and other laser printer service references. These portable guides are especially helpful for on-site service calls when *Apple Service Source* is not readily available.

When using the *Apple Service Guide for LaserWriter Printers (Volume I)*, begin troubleshooting with Flowchart 1 in “LaserWriter II Troubleshooting—Functional Check,” which presents steps for troubleshooting and repairing most deviations from normal operation. The Flowcharts guide you through a comprehensive check of the LaserWriter II, 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. Go to the Table recommended by the Flowchart or choose the Table which most closely describes the problem you are troubleshooting, and follow the step-by-step procedures.

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 are not familiar with the *Apple Service Guide for LaserWriter Printers (Volume I)*, take time to do so now. You will need to accurately use the service guide to complete the practice activities and the module test.

## Technical Info Library

The Technical Info Library (TIL), included with *Apple Service Source* CD, 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 Guides 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.

## LaserWriter II Test Connector

The LaserWriter II Test Connector (part number 077-8319) connects to the DB-25 serial port on the LaserWriter II<sub>f</sub> and II<sub>g</sub> printers. When you install the connector and switch on the printer, the printer LEDs display an error code, if an error exists. To interpret the LEDs, refer to the “II<sub>f</sub>/g Diagnostic Chart,” which is located in the Troubleshooting chapter of the LaserWriter II manual on *Service Source* and in the LaserWriter II SC/NT/NTX/II<sub>f</sub>/II<sub>g</sub> section of the *Apple Service Guide for LaserWriter Printers (Volume I)*.

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 II family of printers.

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

---

# Practice Exercise 1

**Directions**

Refer to the service resources to answer the following questions. Assume you are performing hands-on troubleshooting at your service center. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

1. You are troubleshooting a LaserWriter IINTX printer. What is the first troubleshooting action you should take?

---

---

2. You are troubleshooting a LaserWriter IIf printer using the LaserWriter IIf/g Diagnostic Chart. After installing the LaserWriter II test connector and switching on the printer, you find that all four LEDs are on. What action should you take?

---

---

3. Flowchart 2 of "LaserWriter II Troubleshooting—Print Engine Check" in the *Apple Service Guide for LaserWriter Printers (Volume I)*, refers you to Table D. Following Table D, you find that there is no continuity through the thermoprotector. What action should you take?

---

---

4. While using Flowchart 1 of "LaserWriter II Troubleshooting—Functional Check" in the *Apple Service Guide for LaserWriter Printers (Volume I)*, you find that the Paper-Out and Paper Jam LEDs are flashing. Which flowchart should you use next?

---

---



## Practice Exercise 1

5. You are troubleshooting a LaserWriter IISC print engine. The ready LED lights steadily after warm-up, but the printer does not print a user test page. According to the LaserWriter II Flowcharts file in *Service Source*, what should you do next?

---

---

6. You are using the LaserWriter II Flowchart II in the *Apple Service Guide for LaserWriter Printers (Volume I)* to troubleshoot a LaserWriter IINT and you find that the lower fan is inoperable. You remove the cover set, check for paper jams, re-install the paper cassette and toner cartridge, close the cover, and plug in and switch on the printer. The lower fan still does not operate. You verify that the AC outlet supplies the correct voltage and that the top cover is not open. What should you do next?

---

---

7. You are troubleshooting a LaserWriter IINT. The fuser heater bulb does not light. You consult *Apple Service Guide for LaserWriter Printers (Volume I)* and check the resistance between pins J331-4 and J331-5. The resistance is less than 1 megohms. What should you do next?

---

---

8. You are troubleshooting a LaserWriter IIg and find that the ready LED does not light. What should you do next?

---

---

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

---

## Practice Exercise 1 (Answers)



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

1. Verify the deviation from normal operation.
2. Replace SIMM number 8.
3. Replace the fuser assembly.
4. Flowchart 3—Print Engine Error.
5. Initiate a service test page.
6. Open the cover and check the interlock lever.
7. Replace the fuser assembly.
8. Set the rotary switch on the back of the printer to 4 and install the LaserWriter II Test Connector.

If you missed any items, review this module and correct your answers before you continue.

**When you are ready, begin the module test on the next page.**



## Module Test—Part 1

### Directions

Answer the following questions by referring to the appropriate sections of *Service Source* or the *Apple Service Guide for LaserWriter Printers (Volume I)*. You should be able to correctly answer 80 percent of the questions to pass Part 1. (Note: Write your answers on a separate piece of paper if this manual will be used later by other technicians.)

1. Indicate the reference in the *Apple Service Guide for LaserWriter Printers (Volume I)* that you should use to begin troubleshooting a LaserWriter II printer.
  - A. Flowchart 1
  - B. Table A
  - C. Flowchart 1A
  - D. Flowchart 2
  - E. Table C1
  
2. Using Flowchart 2 of “LaserWriter II Troubleshooting—Print Engine Check” in the *Apple Service Guide for LaserWriter Printers (Volume I)*, you find that the lower fan does not come on. What should you do next?
  - A. Go to Flowchart 3—Communication Check.
  - B. Go to Table D—Heater Bulb Does Not Operate.
  - C. Go to Table K—Laser/Scanner Malfunction.
  - D. Go to Table A—No Power.
  - E. Go to Flowchart 1—Functional Check.
  
3. After you successfully isolate and replace a faulty component, what is the next stage of the hands-on troubleshooting and repair process?
  - A. Verify the deviation from normal operation.
  - B. Return the printer to the customer.
  - C. Fill the paper tray and install a new toner cartridge.
  - D. Verify problem resolution.
  - E. Review your troubleshooting process with the customer.

---

# Module Test—Part 1



4. You are troubleshooting a LaserWriter IINT using Flowchart 3 of “Troubleshooting—Print Engine Error” in the *Apple Service Guide for LaserWriter Printers (Volume I)*. The printer produces a blank user test page. What should you do next?
  - A. Go to Table K.
  - B. Go to Table M3.
  - C. Go to Table D.
  - D. Go to Table M6.
  - E. Go to Table C2.
  
5. Using Flowchart 1 of “LaserWriter II Troubleshooting—Functional Check” in the *Apple Service Guide for LaserWriter Printers (Volume I)*, you find that the printer does not print a user test page. What should you do next?
  - A. Go to Flowchart 2.
  - B. Go to Table A.
  - C. Press the engine self-test/service test page switch.
  - D. Open the face-up tray and check the fuser light.
  - E. Check the preconditioning exposure lamps.
  
6. Which manual, chapter, and section should you consult when using *Service Source* to troubleshoot and repair a LaserWriter IINTX?
  - A. LaserWriter II, Troubleshooting, Flowcharts
  - B. Laser Printers, LaserWriter II, Flowcharts
  - C. Other Printers, LaserWriter II, Specifications
  - D. LaserWriters, Other Laser Printers, Specifications
  
7. You are troubleshooting a LaserWriter IISC using the Flowchart 1—Functional Check in the *Apple Service Guide for LaserWriter Printers (Volume I)*. The printer is connected to a Macintosh computer and selected in the Chooser. Everything checks out until you try to use Print Directory to print a page. The printer will not print when you select **Print Directory**. What should you do next?
  - A. Use the LaserWriter II test connector.
  - B. Print a service test page.
  - C. Replace the toner cartridge.
  - D. Check the SCSI cable connections and terminators.
  - E. Replace the fuser assembly.



## Module Test—Part 1

8. A LaserWriter IISC fuser lamp does not turn on and off. Following the Flowchart 2 in the *Apple Service Guide for LaserWriter Printers (Volume I)*, you remove the fuser assembly. What should you do next?
- A. Replace the fuser lamp.
  - B. Check for continuity through the thermoprotector (TP1).
  - C. Check the cable leading to the fuser lamp.
  - D. Replace the fuser assembly.
  - E. See if connector J209 makes good contact.
9. When using the *Apple Service Guide for LaserWriter Printers (Volume I)* to troubleshoot and repair a LaserWriter II, which Flowchart should you use if you have *not* isolated the problem to one of the major subsystems or to poor print quality?
- A. Flowchart 1—Functional Check
  - B. Flowchart 1A—Functional Check
  - C. Flowchart 2—Print Engine Check
  - D. Flowchart 2A—Print Engine Check
  - E. Flowchart 3—Print Engine Error

**When you finish, check your answers against those given on the next page.**

---

# Module Test—Part 1

**Answers**

Compare your answers to those below:

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

**If you answered fewer than 8 items correctly, review the Troubleshooting module before you go on to the Hands-On Troubleshooting Practice on the next page.**



## Hands-On Troubleshooting Practice

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

### Directions

Follow these steps to complete the practice exercise:

1. Ask your service manager or a colleague to assign you a LaserWriter II printer to troubleshoot and repair.
2. Using *Service Source* and the *Apple Service Guide for LaserWriter Printers (Volume I)*, complete the three stages of hands-on troubleshooting: 1) verify deviation from normal operation, 2) take troubleshooting/resolution actions, and 3) verify problem resolution.
3. Make a copy of the “Troubleshooting and Repair Record” form on the next page. As you complete each troubleshooting stage, fill in the form.

Use the 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 *Service Source* or the *Apple Service Guide for LaserWriter Printers (Volume I)*, list your actions in the order you perform them. Write the names of the parts you check or replace, the names of the flowcharts you use, and the specific tables to which you refer. Be sure to closely follow the troubleshooting procedures in *Service Source* or in the *Apple Service Guide for LaserWriter Printers (Volume I)*.

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

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

4. When you finish repairing the printer, ask your service manager or colleague to review your “Troubleshooting and Repair Record.” If you have done the repair correctly, you are ready to go on to Part 2 of the module test.

# Hands-On Troubleshooting Practice



## Troubleshooting and Repair Record

Your Name \_\_\_\_\_

Laser Printer to Be Repaired \_\_\_\_\_

Deviation from Normal Operation \_\_\_\_\_

Repair Solution \_\_\_\_\_

**Directions:**  
Provide the information requested above. 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.

Figure 3-1  
Troubleshooting and Repair Record form



## Module Test—Part 2

This second and final part of the module test directs you to correctly and efficiently troubleshoot and repair two additional LaserWriter II printers.

### Directions

Follow these directions to complete Part 2 of the module test:

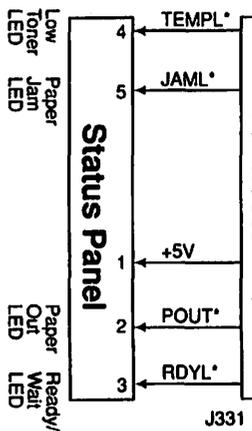
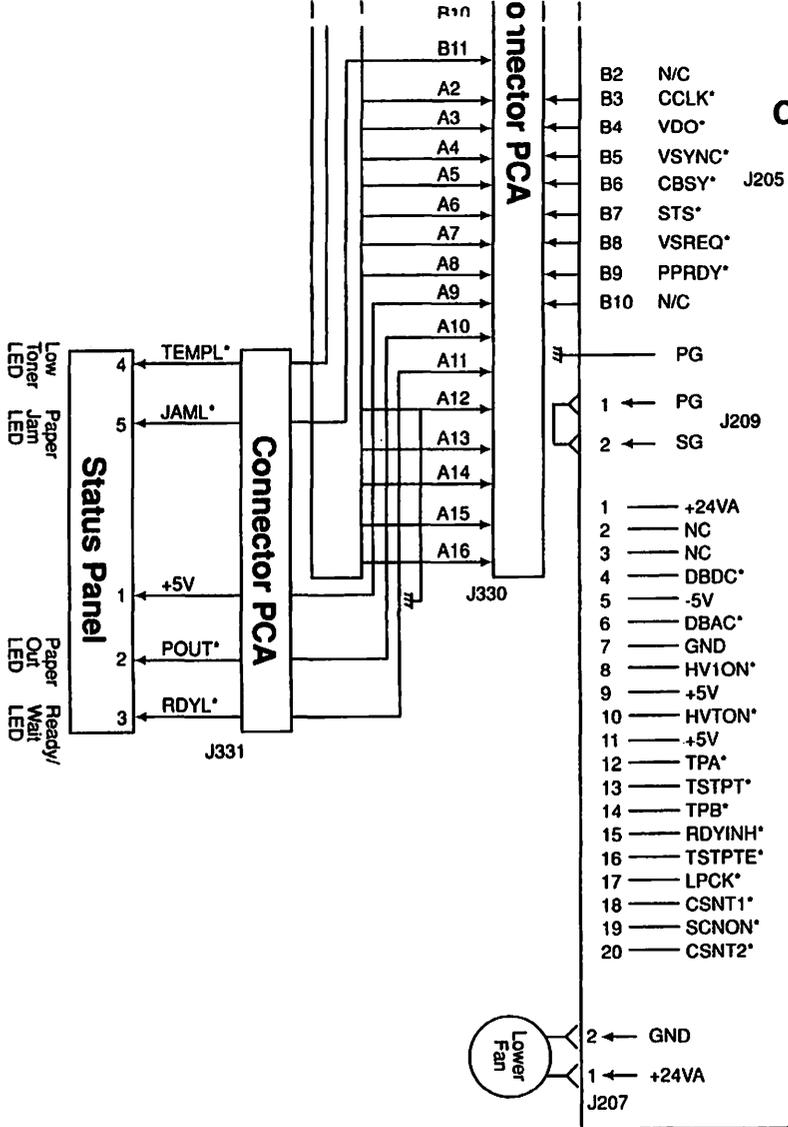
1. Ask your service manager or colleague to assign to you a LaserWriter II printer to troubleshoot and repair.
2. Troubleshoot and repair the printer following the procedures in this module, *Service Source*, and the *Apple Service Guide for LaserWriter Printers (Volume I)*.
3. Record and explain the reasons for each of your actions using a copy of the “Troubleshooting and Repair Record,” as you did in the practice exercise.
4. After you repair the printer, ask your service manager or colleague to review your “Troubleshooting and Repair Record.”
5. If you completed the repair correctly, complete steps 2–4 for a second printer assigned to you.

**When you correctly and efficiently repair two printers, you have completed the LaserWriter II Service Course. Congratulations!**

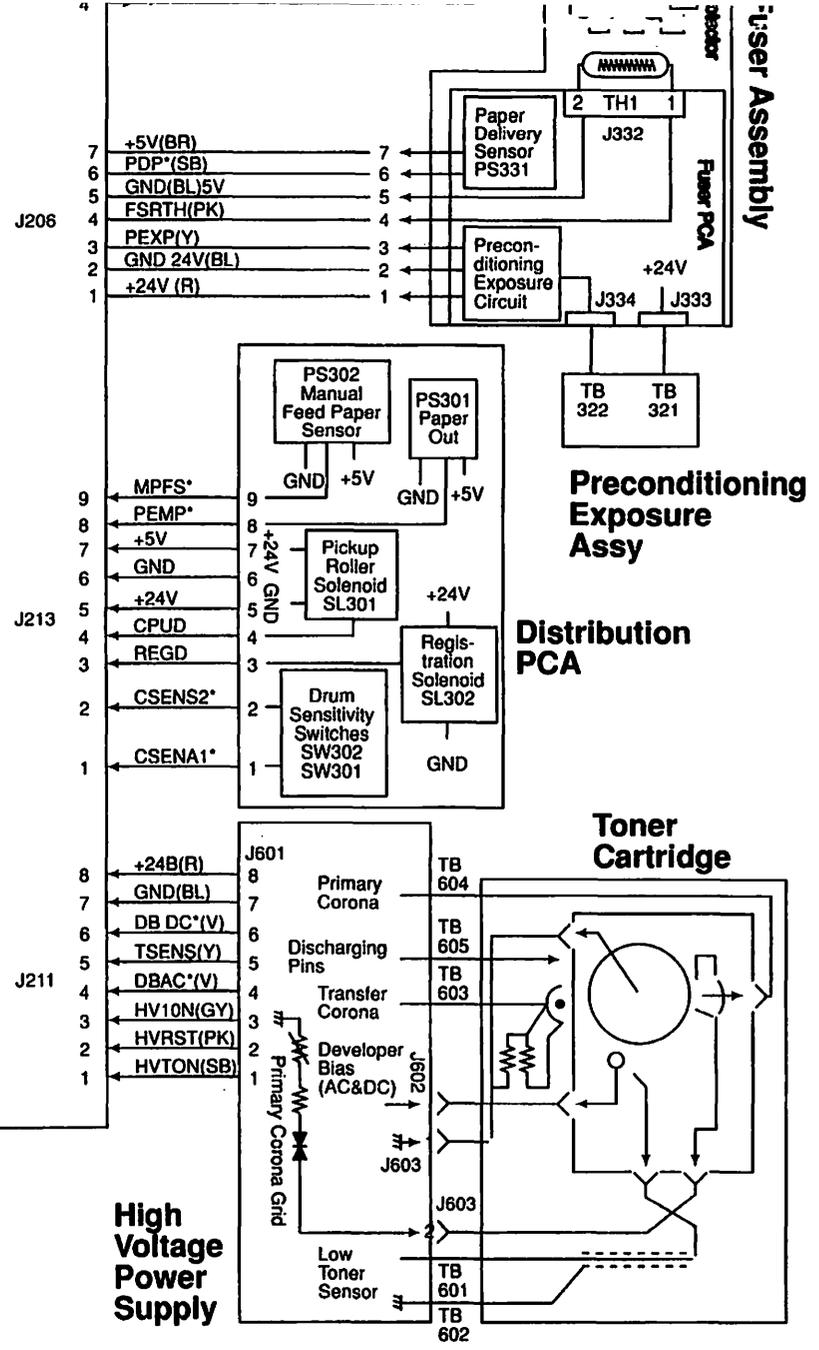
---

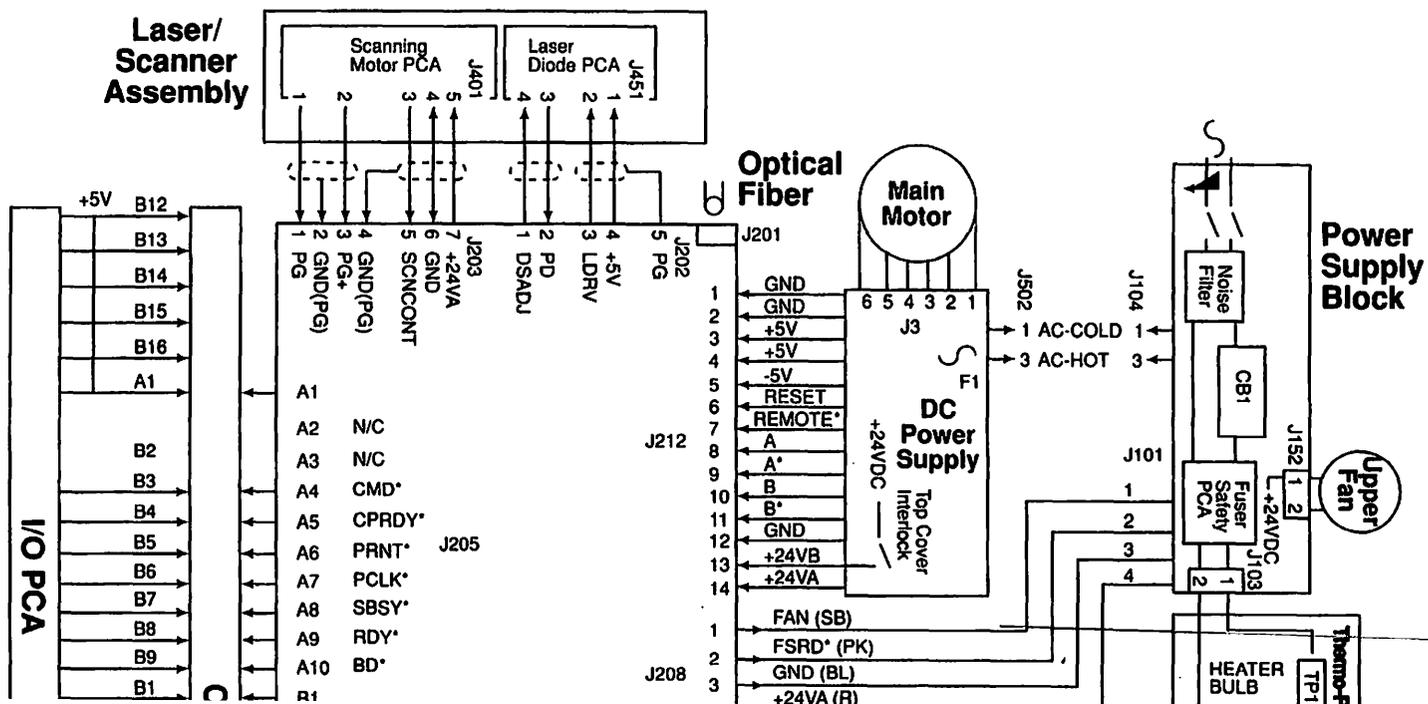
# LaserWriter II Wiring Diagram





**DC Controller PCA**







Apple Computer, Inc.  
1 Infinite Loop  
Cupertino, California 95014