

Service Training



Version 1.1

Personal LaserWriter SC/NT/LS Service Course



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Appendix A Wiring Diagram

Introduction

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Welcome to the Personal LaserWriter Service Course!

This course provides you with the opportunity to practice the skills you need to service the Apple[®] Personal LaserWriter[®] family of printers.

Note: This course covers the Personal LaserWriters LS, LS/L, NT, NTR, and SC. The course does not cover the Personal LaserWriter 300/320.

To provide quality customer service, you must know how to identify printer components and functions; take apart and reassemble the printer; and diagnose problems. The course covers these topics in three main modules:

- Personal LaserWriter Parts and Functions
- Personal LaserWriter Take-Apart and Reassembly
- Personal LaserWriter Troubleshooting

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

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

When you are ready, begin the first module—"Personal LaserWriter Parts and Functions."

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Overview

	To provide quality customer service, you must efficiently identify and diagnose Personal LaserWriter printer components and problems. This module presents each Personal LaserWriter printer subsystem, identifies the subsystem components, and describes their functions. Significant differences between the Personal LaserWriters LS, LS/L, NT, NTR, and SC and other LaserWriter printers are noted throughout the module.
Objectives	By the end of this module, you should be able to:
	• Locate the components and major parts of the four Personal LaserWriter subsystems.
	• Match a list of Personal LaserWriter components and parts with their functions.
	• Identify the functional characteristics that are representative of Personal LaserWriter printers and other Apple LaserWriters.
Required Materials	This module requires the following materials and equipment:
	 Personal LaserWriter printer with the main body panels and I/O board removed, and the laser unit detached Personal LaserWriter Training videotape Apple Service Source CD
Module Organization	This module includes the following sections:
·	 Printer Overview I/O PCB Overview Image Formation Control System Pickup/Feed System Power Distribution System Operational Sequence Module Test

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Overview

Module Test

When you complete all the module activities, take the two-part module test. You should be able to pass the test with with 80 percent accuracy. To take the first part of the test, you will need to ask your manager or a colleague to verify that you can identify the location of Personal LaserWriter printer components and parts. The second part of the test is written, and requires you to:

- Match components and parts with their functions
- Identify the unique functional characteristics of the Personal LaserWriter

When you are ready, begin the first module.

Printer Overview

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This module discusses most Personal LaserWriter printer components; Figure 1-1 orients you to the printer.



Figure 1-1 The Personal LaserWriter views

The Personal LaserWriter has four subsystems that work together to produce printed pages:

- Image formation system
- Pickup/feed system

Control system

Power distribution system

Figure 1-2 on the next page shows the relationships of the four subsystems. You were introduced to the subsystems when you studied LaserWriter theory of operations in the *Introduction to Laser Printer Service* course. This module discusses the systems one-by-one to help you more clearly understand their operation.

Printer Overview



Figure 1-2 The four Personal LaserWriter subsystems

This module does not have locator drawings for all components. Refer to the *Personal LaserWriter Training* videotape and other service references for complete component locations. Review the "Basics," "Specifications," and "Parts" chapters of the "Personal LaserWriter LS, LS/L, NT, NTR, and SC"manual of *Service Source* before you begin the next section of the module. These three sections will help you locate the Personal LaserWriter components and understand their functions.

I/O PCB Overview

The Personal LaserWriter printer is available in five configurations: Personal LaserWriter SC, LS, LS/L, NT, and NTR. We'll take a look at two of the I/O PCBs for the Personal LaserWriter printers. For an overview of the five Personal LaserWriter I/O PCB configurations, refer to the "Basics" and "Specifications" sections of *Service Source*.

This module focuses on the Personal LaserWriter SC and NT I/O PCBs, as Figures 1-3 and 1-4 illustrate.



Figure 1-3 The Personal LaserWriter SC I/O PCB

I/O PCB Overview



Figure 1-4 The Personal LaserWriter NT I/O PCB

I/O PCB Overview

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The Personal LaserWriter NT I/O PCB has a pinwheel DIP switch that looks exactly like the SCSI identification number pinwheel on the Personal LaserWriter SC I/O PCB. Table 1-1 lists the settings for each switch position. The "Chan. Num." column indicates the actual DIP switch setting.

Switch Position	Chan. Num.	Port*	Meaning
0	0	8	AppleTalk, PostScript batch
	1	25	Serial, no input
1	2	8	Serial 9600, N, 8, 1, XON, PostScript batch
	2	25	Serial 9600, N, 8, 1, XON, PostScript batch
2	3	8	Serial 9600, N, 8, 1, DTR, HP Emulation
	3	25	Serial 9600, N, 8, 1, DTR, HP Emulation
3	4	8	Serial 9600, N, 8, 1, DTR, Diablo Emulation
	4	25	Serial 9600, N, 8, 1, DTR, Diablo Emulation
4	5	8	Serial 1200, N, 8, 1, DTR, PostScript batch
	5	25	Serial 1200, N, 8, 1, DTR, PostScript batch
5	6	8	Serial 9600, N, 8, 1, DTR, PostScript batch
	7	25	Serial 9600, N, 8, 1, DTR, PostScript batch
6	8	8	AppleTalk, PostScript batch
	9	25	Serial 9600, N, 8, 1, DTR, PostScript batch
7	0	8	AppleTalk, PostScript batch
	1	25	Serial, no input

* "8" refers to the 8-pin RS-422 LocalTalk port "25" refers to the 25-pin RS-232 port

Table 1-1

The Personal LaserWriter NT DIP switch settings

Continue with the next section—"Image Formation System"—on the following page.

Image Formation System

System Overview

This section presents the locations and functions of the following image formation system components (see Figure 1-5):

- Laser assembly
- Lens assembly
- Scanner assembly
- Optical-fiber cable
- Toner cartridge

- Density-adjusting PCB assembly
- Fuser assembly
- Thermistor
- Heater bulb
- Fuser PCB assembly



Figure 1-5 The Personal LaserWriter image formation system

Image Formation System

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View Part 5—"Apple Personal LaserWriter Image Formation System"—of the *Personal LaserWriter Training* videotape. Part 5 identifies the image formation system components. After viewing the videotape, you should be able to correctly locate each component and define its function.

Continue with Practice Exercise 1 on the next page.

Practice Exercise 1

Directions

This exercise gives you the opportunity to locate Personal LaserWriter image formation system components. **Caution:** The LaserWriter contains potentially dangerous voltage. To eliminate the risk of injury due to shock, disconnect the power cable from the 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 a colleague or your manager to name each item in the list so you can point to it.
 - Laser assembly
 - Lens assembly
 - Scanner assembly
 - Optical-fiber cable
 - Toner cartridge
 - Density-adjusting PCB assembly
 - Fuser assembly
 - Thermistor
 - Heater bulb
 - Fuser PCB assembly

If you are unable to locate some components, review the videotape or the Personal LaserWriter "Parts" chapter in *Service Source*.

When you are ready, continue with the image formation system section on the next page.

Image Formation System

Component Functions	The section describes the functions of the image formation system components.
	• The laser assembly generates the laser beam that reflects off the rotating scanning mirror onto the photosensitive drum.
	• The lens assembly contains the collimator lens that aligns the laser beam into parallel beams. The beams strike the scanning mirror, which rotates at a constant speed.
	• The scanner assembly scans the photosensitive drum. The assembly consists of the scanning motor and scanning mirror.
	• The optical-fiber cable carries the laser light signal from the lens to the DC controller PCB, which initiates the beam to start a new scan.
	• The toner cartridge contains the primary roller, developing cylinder, photosensitive drum, and drum-cleaning unit. The cartridge dispenses toner onto the drum.
	• The density-adjusting PCB assembly adjusts the print density by increasing or decreasing voltage to the primary roller.
	• The fuser assembly contains the fuser PCB assembly, thermistor, and heater bulb. The fuser assembly fuses the toner onto the paper. If the paper fails to reach and clear the delivery sensor within the necessary time, a paper jam occurs.
	These three components are located in the fuser assembly:
	• The thermistor detects the surface temperature of the upper fixing roller.
	• The heater bulb heats the fuser roller, which fixes the toner to the paper.
	• The fuser PCB assembly connects the AC portion of the power supply to the fuser heater bulb.
	You may want to review Part 5 of the <i>Personal LaserWriter Training</i> videotape so you can focus on the component functions instead of their names and locations.
	Continue with Practice Exercise 2 on the next page.

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Practice Exercise 2

Directions

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

- ____ Scanner assembly
- Toner cartridge
- Optical-fiber cable
- Density-adjusting PCB assembly
- ____ Laser assembly
- ____ Fuser assembly
- Fuser PCB assembly
- ___ Thermistor
- Heater bulb
- Lens assembly

- A. Adjusts print density by increasing or decreasing voltage to the primary roller.
- B. Contains the collimator lens, which aligns the laser beam into parallel beams that strike the scanning mirror.
- C. Carries the laser signal from the lens to the DC controller PCB, which initiates the beam to start a new scan.
- D. Contains the primary roller, developing cylinder, photosensitive drum, and drum-cleaning unit. Dispenses toner.
- E. Scans the photosensitive drum. Contains the scanning motor and scanning mirror.
- F. Detects the surface temperature of the upper fixing roller.
- G. Generates the laser beam that reflects off the rotating scanning mirror onto the photosensitive drum.
- H. Contains the fuser PCB assembly, thermistor, and heater bulb. Fuses the toner onto the paper.
- I. Connects the AC portion of the power supply to the fuser heater bulb.
- J. Heats the fuser roller, which fixes toner to the paper.

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

Practice Exercise 2 (Answers)

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Compare your answers to Practice Exercise 2 with those below.

- <u>E</u> Scanner assembly
- <u>D</u> Toner cartridge
- <u>C</u> Optical-fiber cable
- A Density-adjusting PCB assembly
- <u>G</u> Laser assembly
- <u>H</u> Fuser assembly
- **_** Fuser PCB assembly
- <u>F</u> Thermistor
- ⊥ Heater bulb
- <u>B</u> Lens assembly

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

When you are ready, begin the next section-"Control System."

Control System

System Overview

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This section presents the locations and functions of the following control system components:

- I/O board
- Interconnect PCB
- DC controller PCB
- Sensor PS11 (Access door)
- Switches 901, 902, and 903
- Sensor PS12 (Paper delivery)
- Status panel

- Sensor PS901 (Paper-out)
- Sensor PS501 (Multipurpose tray)
- Sensor PS13 (Paper pickup)
- Sensor PS502 (Face-up cover)

Figure 1-6 shows the location of the PCBs, and sensors PS11 and PS502. Sensor PS11 monitors if the front access door is open and if the toner cartridge is installed. PS502 senses if the face-up cover is closed. Figure 1-7 on the next page illustrates the functional and physical relationship of control system components, including all sensors and switches from the above list (excluding PS11 and PS502).



Figure 1-6

Personal LaserWriter control system components and sensors

View Part 6—"Apple Personal LaserWriter Control System"—of the *Personal LaserWriter Training* videotape. Part 6 identifies the control system components and functions. After viewing the tape, you should be able to locate all control system components and identify their functions.

PERSONAL LASERWRITER PARTS AND FUNCTIONS



Continue with Practice Exercise 3 on the next page.

Practice Exercise 3

Directions

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

- 1. Using appropriate reference documents, practice locating each component from the component list below until you can locate all components from memory.
- 2. Ask a colleague or your manager to name each item in the list so you can point to it.
 - I/O board
 - Interconnect PCB
 - DC controller PCB
 - Sensor PS11 (Access door)
 - Sensor PS901 (Paper-out)
 - Sensor PS501 (Multipurpose tray)
 - Sensor PS13 (Paper pickup)
 - Sensor PS502 (Face-up cover)
 - Switches 901, 902, and 903
 - Sensor PS12 (Paper delivery)
 - Status panel

If you are unable to locate some components, review the videotape or the Personal LaserWriter "Parts" chapter in *Service Source*.

When you are ready, continue with the control system section on the next page.

Control System

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Component Functions	This section describes the functions of the control system components:				
	• The I/O board, at the top of the printer, controls communications between the printer and external devices, and prints the user test page. The Personal Laser Writer NT I/O board contains the PostScript ROMs that convert PostScript commands from the computer into bitmap images, which are then sent to the DC controller PCB.				
	• The interconnect PCB connects the print engine and I/O board.				
	• The DC controller PCB, below the I/O board in the center of the printer, is the Personal LaserWriter "command center." The controller controls and monitors the three other printer systems: power distribution, image formation, and pickup/feed. The controller also contains the service test print button.				
	• Sensor PS11 detects whether the toner cartridge is installed and if the front access door is open.				
	• Sensor PS901 detects paper in the paper cassette tray.				
	• Sensor PS501 detects paper in the multipurpose tray.				
	• Sensor PS13 detects paper in the pickup unit.				
	• Sensor PS502 detects if the face-up cover is closed.				
	• Switches 901, 902, and 903 detect the size of the paper cassette.				
	• Sensor PS12 detects if a sheet of paper exits the fuser assembly. If the sensor does not activate within a set time, a paper jam occurs. If the sensor activates, but does not deactivate within a set time, the paper jam indicator lights.				
	• The status panel indicates the operational status of the printer.				
	You may want to review Part 6 of the <i>Personal LaserWriter Training</i> videotape so you can focus on the component functions instead of their names and locations.				
	Continue with Practice Exercise 4 on the next page.				

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Practice Exercise 4

Directions

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

- ___ Status panel
- ___ I/O board
- ___ Sensor PS901
- ____ Sensor PS11
- ____ Sensor PS12
- ___ Sensor PS502
- ___ Interconnect PCB
- ___ DC controller PCB
- _____ Switches 901, 902, 903
- ___ Sensor PS501
- ____ Sensor PS13

- A. Contains the I/O board operating code.
- B. Detects if a sheet of paper exits the fuser assembly.
- C. Detects if the toner cartridge is installed or if the front access door is open.
- D. Connects the printer engine and I/O board.
- E. Secures sensor PS11 and sensor PS12 to the inner cover.
- F. Senses the size of the paper cassette.
- G. Indicates the operational status of the printer.
- H. Detects paper in the multipurpose tray.
- I. Contains connectors J209, J504, J305, J502, and J505.
- J. Detects paper in the paper cassette tray.
- K. Detects if the face-up cover is closed.
- L. Detects paper in the pickup unit.
- M. Controls communications between the printer and external devices, and prints the user test page.
- N. Contains memory to support the I/O board.
- O. Controls and monitors the three other printer systems: power distribution, image formation, and pickup/feed.

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

Practice Exercise 4 (Answers)

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

- G_Status panel
- M_ I/O board
- J_ Sensor PS901
- C_ Sensor PS11
- _B_ Sensor PS12
- K_ Sensor PS502
- D. Interconnect PCB
- O_DC controller PCB
- .E. Switches 901, 902, and 903
- H_ Sensor PS501
- L_ Sensor PS13

If you missed any items, review this section of the module 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 locations and functions of the following pickup/feed system components:

- Main motor
- Drive assembly
- Drum drive assembly
- Paper cassette tray
- Cassette stop cover
- Cassette pickup roller
- Solenoid SL901 (cassette pickup roller clutch)
- Cassette feeder roller shaft
- Solenoid SL902 (cassette feeder roller clutch)
- Cassette feeder PCB assembly
- Multipurpose tray assembly

- Solenoid SL501 (paper pickup roller clutch)
- Separation pad
- Transfer guide assembly
- Transfer roller
- Left and right transfer roller mount assemblies
- Deflector
- Face-down delivery assembly
- Face-up delivery drive assembly
- Face-up cover assembly
- Face-up tray assembly
- Feeder assembly (includes pickup roller assembly)

Figures 1-8, 1-9, and 1-10 on the following pages show three views of the pickup/feed system. The figures do not include all items in the above list, but all items are identified and described in the videotape.

Pickup/Feed System

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Figure 1-8 The Personal LaserWriter pickup/feed system

Pickup/Feed System



Figure 1-9 The Personal LaserWriter pickup/feed system

Pickup/Feed System

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Figure 1-10 The Personal LaserWriter pickup/feed system

View Part 7—"Apple Personal LaserWriter Paper Pickup/Feed System" of the *Personal LaserWriter Training* videotape. Section 7 identifies pickup/feed system components and their functions. After viewing the videotape, you should be able to correctly locate all pickup/feed system components and define their functions.

Continue with Practice Exercise 5 on the next page.

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Practice Exercise 5

Directions

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

- 1. Using appropriate reference documents, practice locating each component from the component list below until you can locate all components from memory.
- 2. Ask a colleague or your manager to name each item in the list so you can point to it.
 - Main motor
 - Drive assembly
 - Drum drive assembly
 - Paper cassette tray
 - Cassette stop cover
 - Cassette pickup roller
 - Solenoid SL901 (cassette pickup roller clutch)
 - Cassette feeder roller shaft
 - Solenoid SL902 (cassette feeder roller clutch)
 - Cassette feeder PCB assembly
 - Multipurpose tray assembly
 - Solenoid SL501 (paper pickup roller clutch)
 - Feeder assembly (includes pickup roller assembly)
 - Separation pad
 - Transfer guide assembly
 - Transfer roller
 - Left and right transfer roller mount assemblies
 - Deflector
 - Face-down delivery assembly
 - Face-up delivery drive assembly
 - Face-up cover assembly
 - Face-up tray assembly

If you are unable to locate some components, review the videotape or the Personal LaserWriter "Parts" chapter in *Service Source*.

When you are ready, continue with the pickup/feed section on the next page.

Pickup/Feed System

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Component Functions	This section describes the functions of the pickup/feed system components.
	• The main motor powers all mechanical printer parts, including the photosensitive drum, pickup rollers, and feed rollers.
	• The drive assembly transfers power from the main motor to other drive assemblies.
	• The drum drive assembly transfers main motor power to the photosensitive drum.
	• The paper cassette tray holds paper for the automatic paper cassette.
	• The cassette stop cover extends from the rear of the printer and covers the end of a legal-size paper cassette tray.
	• The cassette pickup roller picks up sheets of paper from the paper cassette tray and moves them to the cassette feeder rollers.
	• Solenoid SL901 controls the cassette pickup roller drive.
	• The cassette feeder roller shaft moves paper from the cassette pickup roller to the feeder assembly.
	• The SL902 solenoid controls the cassette feeder roller drive.
	• The cassette feeder PCB assembly drives the paper cassette sensors and activates the solenoids.
	• The multipurpose tray assembly feeds single sheets of paper and envelopes into the printer.
	• The SL501 solenoid controls the pickup roller drive.
	• The feeder assembly (includes the pickup roller assembly) moves paper from the cassette feeder rollers or multipurpose tray toward the photosensitive drum and transfer roller.
	• The separation pad separates paper from the multipurpose tray as the pickup roller assembly feeds the paper forward.

- The transfer guide assembly holds the transfer roller.
- The transfer roller applies a positive charge to the paper. The charge causes the toner to transfer from the photosensitive drum to the paper.

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Pickup/Feed System

- The left and right transfer roller mount assemblies secure the transfer assembly to the front cover.
- The deflector deflects paper to the open face-up paper tray.
- The face-down delivery assembly delivers paper face-down on top of the upper panel.
- The face-up delivery drive assembly transfers power from the main motor to the face-up delivery roller.
- The face-up cover (and assembly) allows jammed paper to be removed.
- The face-up tray assembly receives paper that exits the printer.

You may want to review Part 7 of the *Personal LaserWriter Training* videotape so you can focus on the functions of the components instead of their locations.

Continue with Practice Exercise 6 on the next page.

Practice Exercise 6

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Directions

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

- ___ Main motor
- ____ Drive assembly
- ____ Drum drive assembly
- ____ Feeder assembly
- Separation pad
- ____ Transfer guide assembly
- ____ Transfer roller
- ___ Deflector
- ___ Cassette stop cover
- ____ Cassette feeder roller shaft
- Cassette feeder PCB assembly
- ____ Solenoid SL501
- ____ Solenoid SL902
- ____ Solenoid SL901
- ____ Cassette pickup roller

- A. Holds the transfer roller.
- B. Separates paper from the multipurpose tray as the pickup roller assembly feeds the paper forward.
- C. Powers the printer mechanical drive parts.
- D. Transfers power from the main motor to the photosensitive drum.
- E. Moves paper from the cassette feeder rollers or multipurpose tray toward the photosensitive drum and transfer roller.
- F. Deflects paper to the face-up or face-down delivery assembly.
- G. Applies positive charges to the paper and causes toner to transfer from the photosensitive drum to the paper.
- H. Extends from the rear of the printer and covers the end of the legal-size paper cassette tray.
- I. Controls the cassette pickup roller drive.
- J. Controls the cassette feeder roller drive.
- K. Drives the paper cassette sensors and activates the solenoids.
- L. Controls the pickup roller drive.
- M. Moves paper from the cassette pickup roller to the feeder assembly.
- N. Transfers power from the main motor to other drive assemblies.
- O. Picks up sheets from the paper cassette tray and moves them to the cassette feeder rollers.

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

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Practice Exercise 6 (Answers)

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

- <u>C</u> Main motor
- <u>N</u> Drive assembly
- D Drum drive assembly
- <u>E</u> Feeder assembly
- <u>B</u> Separation pad
- <u>A</u> Transfer guide assembly
- <u>G</u> Transfer roller
- <u>F</u> Deflector
- <u>H</u> Cassette stop cover
- <u>M</u> Cassette feeder roller shaft
- <u>K</u> Cassette feeder PCB assembly
- <u>L</u> Solenoid SL501
- ⊥ Solenoid SL902
- ____ Solenoid SL901
- O Cassette pickup roller

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-"Power Distribution System."

Power Distribution System



The Personal LaserWriter power distribution system

Now view Part 8—"Apple Personal LaserWriter Power Distribution System" of the *Personal LaserWriter Training* videotape. Part 8 visually identifies the power distribution system components. After viewing the videotape, you should be able to correctly locate each part and define its function.

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

Directions

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

- 1. Using appropriate reference documents, practice locating each component from the component list below until you can locate all components from memory.
- 2. Ask a colleague or your manager to name each item in the list so you can point to it.
 - Power switch SW11
 - Power supply
 - Fuser assembly power switch SW101
 - High-voltage power supply PCB
 - High-voltage contact assembly
 - Fan
 - Circuit breaker 1 CB101
 - AC power connector

If you are unable to locate some components, review the videotape or the Personal LaserWriter "Parts" chapter in *Service Source*.

When you are ready, continue with the power distribution section on the next page.

Power Distribution System

Component Functions	This section describes the functions of the power distribution system components.
	• The power switch SW11 turns the printer on and off.
	• The power supply houses the AC power supply PCB, the DC power supply PCB, power cord connector, circuit breaker, and fuse.
	• The fuser assembly power switch SW101 cuts off power to the fuser assembly heater bulb when the front access door opens.
	• The high-voltage power supply PCB provides high voltage to the primary and transfer rollers and the developing cylinder.
	• The high-voltage contact assembly connects the high-voltage power supply to the primary and transfer rollers and developing cylinder contacts.
	• The fan removes warm air from inside the Personal LaserWriter.
	• Circuit Breaker 1 CB101 protects the power supply.
	• The AC Power receptacle connects to the AC power cord.
	You may want to review Part 8 of the <i>Personal LaserWriter Training</i> videotape so you can focus on the component functions instead of their locations.
	Continue with Practice Exercise 8 on the next page.

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Practice Exercise 8

Directions

Match each power distribution system component with its function by writing the letter of the function in the space below. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicians.)

- Power switch SW11
- ____ Fan
- ____ Power supply
- Fuser assembly power switch SW101
- ____ Circuit breaker 1 CB101
- High-voltage power supply PCB
- ____ High-voltage contact assembly

- A. Removes hot air from the Personal LaserWriter.
- B. Houses the AC power supply PCB, the DC power supply PCB, power cord connector, circuit breaker, and fuse.
- C. Provides high voltage to the primary and transfer rollers and the developing cylinder.
- D. Powers the printer on and off.
- E. Connects the high-voltage power supply to the primary and transfer rollers and developing cylinder contacts.
- F. Resets the power supply.
- G. Cuts off power to the fuser assembly heater bulb when the front access door opens.

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.

- <u>D</u> Power switch SW11
- <u>B</u> Power supply
- <u>G</u> Fuser assembly power switch SW101
- <u>F</u> Circuit breaker 1 CB101
- <u>_</u> High-voltage power supply PCB
- <u>E</u> High-voltage contact assembly

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

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

Operational Sequence

	In the previous sections you learned to identify the four major Personal LaserWriter subsystems and their components and functions. The Personal LaserWriter uses similar technologies as other Apple LaserWriter families, but has physical and functional differences. This section describes the Personal LaserWriter print cycle and the functional differences between the Personal LaserWriter LS, LS/L, NT, NTR, and SC printer and other Apple LaserWriter printers. (Note: This course does not cover the Personal LaserWriter 300/320).
Print Cycle	The print cycle has the following five major stages:
	Stage 1—Image Formation:
	 The DC controller activates the main motor, which rotates the photosensitive drum and developing cylinder in the toner cartridge. The DC controller activates the scanning motor. The pickup/feed system activates. Sensor PS501 senses paper in the multipurpose tray and sensor PS901 senses paper in the cassette. The paper pickup sensor PS13 senses paper. Three switches (SW901, SW902, and SW903) sense the size of the cassette in the cassette feeder. If solenoid SL501 goes on, then multipurpose feed is selected. If solenoid SL901 and SL902 go on, then cassette feed is selected. Sensors PS13 and PS12 detect the paper and guide it through the delivery system. The high-voltage power supply activates. The drum indicates sensitivity levels to the DC controller. The DC controller adjusts the laser beam intensity. Sliding the print density adjustment lever changes the DC bias and the potential between the cylinder and the drum, which changes the print density. The primary charging roller applies a uniform negative charge to the photosensitive drum. Stage 2—Development: The toner developer cylinder develops the latent image. Stage 3—Transfer: Toner transfers to paper via the transfer roller. The static-charge eliminator emits negative voltage that separates the paper from the drum.

Operational Sequence

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Stage 4—Fixing:

- The fixing rollers feed paper through the fuser. The main motor powers the fixing unit upper and lower rollers and the delivery rollers.
- The fuser assembly heats the paper and applies pressure to the toner image, which fuses to the paper. Thermistors monitor the temperature of the hot rollers.

Stage 5—Drum cleaning: The cleaning blade removes toner from the photosensitive drum.

Functional Comparison

The unique functional characteristics of the Personal LaserWriter LS, LS/L, NT, NTR, SC are:

- 1. The Personal LaserWriter uses a primary roller and a transfer roller. All other LaserWriter printers use a primary corona wire and transfer corona wire.
- 2. The Personal LaserWriter rollers emit considerably less ozone than the corona wires and consume less voltage. The Personal LaserWriter does not require an ozone filter.
- 3. The Personal LaserWriter has two-instead of one-types of pickup rollers:
 - The half-moon-shape cassette paper pickup rollers are like the LaserWriter Plus.
 - The round, single-sheet paper pickup rollers are like the LaserWriter II.
- 4. The Personal LaserWriter fuser assembly does not use a felt pad.
- 5. The Personal LaserWriter does not require a preconditioning exposure lamp— the primary roller applies a more uniform charge to the photosensitive drum.
- 6. The Personal LaserWriter does not need a preconditioning exposure shutter on the toner cartridge. The printer has a slot for the laser beam to expose the photosensitive drum. **Note:** Be sure to keep the toner cartridge covered or out of direct or strong light when you remove it from the LaserWriter. Direct light can burn the photosensitive drum.
- 7. The Personal LaserWriter uses cassette feed rollers instead of the registration roller, shutter, or solenoid used by the LaserWriter II. The rollers cause the paper to arch and align with the rollers.

Continue with Practice Exercise 10 on the next page.

Practice Exercise 10

Directions

Intentify the unique Personal LaserWriter components by placing an X in the space next to each unique component. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicians.)

- ____ Primary corona wire
- ____ Transfer roller
- ___ Felt pad
- ____ Laser and preconditioning shutters on toner cartridge
- ____ Laser access slot
- Preconditioning exposure lamp
- ____ Transfer corona wire
- ___ Ozone filter
- ____ Registration rollers, shutter, and solenoid

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

Practice Exercise 10 (Answers)

Compare your answers to Practice Exercise 10 with the answers below.

- ____ Primary corona wire
- X Transfer roller
- ____ Felt pad
- ____ Laser and preconditioning shutters on toner cartridge
- <u>X</u> Laser access slot
- ___ Preconditioning exposure lamp
- ____ Transfer corona wire
- ___ Ozone filter
- ____ Registration rollers, shutter, and solenoid

If you missed an item, review this section of the module and correct your answers before you continue.

When you are ready, begin the module test.

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Module Test

To pass the module test, you should have correctly answered 80 percent of the practice exercise questions. If you need to, review this module and/or view the *Personal LaserWriter Training* videotape before you take the test.

The test has two sections:

Section A—Ask your manager or colleague to read the names of the four Personal LaserWriter subsystem components and verify that you can point to them correctly. (The lists of component names are on pages 10, 16, 24, and 30.)

Section B—You will match the four Personal LaserWriter subsystem components with their functions and identify the functional differences between the Personal LaserWriter printer and other LaserWriter printers. Section B begins on the next page.

When you are ready, ask your manager or colleague to administer Section A of the test.

Module Test—Section B

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Part 1 Directions Match each image formation and control system component with its function by writing the letter of the function in the space provided. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicans.)

- ___ Scanner assembly
- Toner cartridge
- Optical-fiber cable
- Density-adjusting PCB assembly
- --- Laser assembly
- Fuser assembly
- Fuser PCB assembly
- ____ Thermistor
- Heater bulb
- ____ Lens assembly
- ____ I/O PCB board
- Sensor PS901
- ____ Sensor PS502
- Interconnect PCB
- DC controller PCB
- _____ Switches 901, 902, 903
- --- Sensor PS501
- ____ Sensor PS13

sor PS13

When you finish, continue on the next page.

- A. Contains the collimator lens, which aligns the laser beam into parallel beams that strike the hexagonal scanning mirror.
- B. Dispenses toner and contains the primary charging roller, developing cylinder, photosensitive drum, and drum-cleaning unit.
- C. Generates the laser beam that reflects off the rotating hexagonal scanning mirror onto the photosensitive drum.
- D. Carries the laser signal (reflected from the lens to the DC controller PCB) and indicates the beam is about to start a new scan.
- E. Scans the photosensitive drum and contains the scanning motor mirror.
- F. Adjusts the print density by increasing or decreasing voltage to the primary roller.
- G. Detects the upper fixing roller temperature.
- H. Heats and fixes toner to the paper.
- I. Connects the AC portion of the power supply to the fuser assembly.
- J. Contains the fuser PCB assembly, thermistor, and heater bulb. Fuses toner onto the paper.
- K. Connects the print engine and I/O board.
- L. Senses the paper cassette size.
- M. Detects paper in the multipurpose tray.
- N. Detects paper in the paper cassette tray.
- O. Detects if the face-up cover is closed.
- P. Detects paper in the pickup unit.
- Q. Controls communication between the printer and computers, and prints the user test page.
- R. Controls and monitors the other three printer systems: power distribution, image formation, and pickup/feed.

Module Test—Section B

Part 2 Directions	Match each pickup/feed and powe writing the letter of the function in separate piece of paper if this work	r dis 1 the 4boc	tribution system component with its function by space below. (Note: Write your answers on a ok will be used later by other technicans.)
	Drum drive assembly	A.	Transfers the main motor power and rotates the photosensitive drum.
	Feeder assembly	B.	Moves paper from cassette feeder rollers or pickup roller assembly toward the
	— Transfer roller	C.	photosensitive drum and transfer roller. Applies positive charges to the paper, causing
	Cassette feeder roller		toner to transfer from the photosensitive drum to the paper.
	Cassette feeder PCB assembly	D. E.	Controls the cassette pickup roller drive. Controls the cassette feeder roller drive.
	Solenoid SL902	F.	Drives the paper pickup sensors and activates the solenoids.
	Solenoid SL901	G. H.	Moves paper to the feeder assembly. Picks up paper from the paper cassette tray.
	— Cassette pickup roller shaft and rollers	I.	Houses the AC power supply PCB, the DC power supply PCB, power cord connector, and circuit breaker 1.
	— Power switch SW11	J.	Cuts off power to the fuser assembly heater bulb when the front access door opens.
	— Power supply	K. L.	Powers the printer on and off. Connects the high-voltage power supply to the
	— Power switch SW101		primary and transfer rollers and developing cylinder contacts.
	— Circuit breaker 1	М.	Provides voltage to the primary and transfer rollers and the developing cylinder.
	— High-voltage power supply PCB	N.	Resets the power supply.

____ High-voltage contact assembly

When you finish, continue on the next page.

Module Test—Section B

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Part 3 DirectionsIdentify the unique Personal LaserWriter components by writing an X next to the unique
components. (Note: Write your answers on a separate piece of paper if this workbook
will be used later by other technicans.)

- Laser and preconditioning shutters on toner cartridge
- Registration rollers, shutter, and solenoid
- Primary corona wire
- Preconditioning exposure lamp
- Felt pad
- Transfer corona wire
- Transfer roller
- Laser access slot
- Ozone filter

When you complete the test, compare your answers with those on the next pages.

Module Test—Section B (Answers)

Part 1 Answers	E	Scanner assembly

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- _B_ Toner cartridge
- ____ Optical-fiber cable
- ____ Density-adjusting PCB assembly
- _C_ Laser assembly
- ____ Fuser assembly
- ____ Fuser PCB assembly
- <u>G</u> Thermistor
- _H_ Heater bulb
- _A_ Lens assembly
- _Q_ I/O PCB board
- _N_ Sensor PS901
- _O_ Sensor PS502
- <u>K</u> Interconnect PCB
- _R_ DC controller PCB
- _L_ Switches 901, 902, 903
- _M_ Sensor PS501
- _P_ Sensor PS13

Module Test—Section B (Answers)

Part 2 Answers

A Drum drive assembly

B Feeder assembly

- _C_ Transfer roller
- _G_ Cassette feeder roller
- _F_ Cassette feeder PCB assembly
- <u>E</u> Solenoid SL902
- _D_ Solenoid SL901
- _H_ Cassette pickup roller shaft and rollers
- <u>K</u> Power switch SW11
- ____ Power supply
- ____ Power switch SW101
- _N_ Circuit breaker 1
- _M_ High-voltage power supply PCB
- _L_ High-voltage contact assembly

Module Test—Section B (Answers)

- Part 3 Answers _____ Laser and preconditioning shutters on toner cartridge
 - _____ Registration rollers, shutter, and solenoid
 - ____ Primary corona wire
 - ____ Preconditioning exposure lamp
 - ____ Felt pad
 - ____ Transfer corona wire
 - <u>X</u> Transfer roller
 - X Laser access slot
 - ____ Ozone filter

If you did not answer correctly at least 80% of the items on each of the three parts of Module Test—Section B, review the module before you go on. Then begin the next module—"Personal LaserWriter Take-Apart."

Overview

	Servicing the Personal LaserWriter printer depends on your ability to accurately remove and replace parts. You will use the information you learned in the previous module about the subsystem conponents to take apart the Personal LaserWriter printer. The <i>Personal LaserWriter Training</i> videotape demonstrates how to remove and replace the parts that you will service most often.
Objectives	Take apart and reassemble the Personal LaserWriter printer without damaging the printer by referring to the <i>Personal LaserWriter Training</i> videotape and <i>Service Source</i> .
Required Materials	 This module requires the following materials and equipment: Personal LaserWriter printer Phillips #2 screwdrivers—small, medium, and long (magnetized) Small flat-blade screwdriver Grounded ESD workstation Personal LaserWriter Training videotape Service Source
Module Organization	This module has two sections—"Overview" and "Take-Apart Instructions." The take- apart instructions list the components you will take apart and reassemble.
Module Test	You will meet the module objectives when you reassemble the Personal LaserWriter without damaging any parts and you print a user test page.

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Take-Apart Instructions

The following list contains the components you wil most frequently replace:

- Top cover
- I/O shield
- End plate
- Fan
- Mounting sensor plate
- Density-adjusting PCB assembly
- Power supply
- High-voltage power supply
- Interconnect PCB
- Heater bulb

- DC controller PCB
- DC controller mounting plate
- Laser assembly
- Lens assembly
- Scanner assembly
- Main motor
- Transfer guide assembly
- Transfer roller
- Fuser assembly

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

- Review Figures 2-1 and 2-2 on the following pages for an overview of the front access door assembly and main engine body take apart. Then review the "Take Apart" chapter in *Service Source*.
- View Part 9—"Apple Personal LaserWriter Take-Apart" of the *Personal LaserWriter Training* videotape. Part 9 shows how remove and replace the components above.

You can watch the entire video and then refer to *Service Source* for detailed instructions for removing/replacing all components. Or you can watch the procedures for one or two parts, use *Service Source* to remove the part(s), and then return to the video for each remaining procedure.

• Use the Take-Apart/Reassembly Checklist on the page 49 as you remove and replace each component. Be sure to show your manager or colleague all the modules you have removed before you begin reassembly.

Note: Be sure to keep each screw with the part from which it was taken. Replace silvercolored screws in the correct location or you may reduce the contact with ground and cause premature component failure.



The Personal LaserWriter front access door assembly

PERSONAL LASERWRITER TAKE-APART



Take-Apart Instructions

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Take-Apart/Reassembly Checklist

Remove	Replace	
		Top cover
		I/O shield and end plate
		Fan
		Sensor mounting plate
		Density-adjusting PCB assembly
		Power supply
		High-voltage power supply
		Interconnect PCB
		DC controller PCB and DC controller mounting plate
		Laser assembly
		Lens assembly and scanner assembly
		Main motor
		Transfer guide assembly and transfer roller
		Fuser assembly
		Heater bulb (only if requested by your Course Manager)
		Ask your manager or a colleague to check components removed

When you completely reassemble the Personal LaserWriter, print a user test page to verify that the printer is operating properly.

When you are ready, begin the next module—"Personal LaserWriter Troubleshooting."

PERSONAL LASERWRITER TAKE-APART

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Overview

	In the <i>Introduction to Laser Printer Service</i> 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 Personal LaserWriter. The term "Personal LaserWriter printer" in this module refers to the Personal LaserWriter NT, NTR, and SC except where otherwise noted. The Personal LaserWriter LS and LS/L discussion is in a separate section of this module.
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 Personal LaserWriter failure.
	2. Return a printer to functional condition when given Apple service reference materials and a faulty Personal LaserWriter printer.
Required Materials	This module requires the following materials:
	 Service Source (February 1996 or later) Apple Service Guide for LaserWriter Printers, Volume I
Module Organization	This module includes six sections:
	• "Overview" provides an overview of this module.
	• "Hands-On Troubleshooting" reviews the hands-on troubleshooting process and when to use the service resources.
	• "Personal LaserWriter LS" provides information and procedures specific to troubleshooting the Personal LaserWriter LS.
	• "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 about logical troubleshooting that you should be able to answer with at least 80 percent accuracy; Part 2 directs you to troubleshoot and repair two faulty Personal LaserWriter printers. To successfully complete the test, you must accurately use <i>Service Source</i> and the <i>Apple Service Guide for LaserWriter Printers</i> .

Hands-On Troubleshooting

This section reviews the hands-on troubleshooting process in the Introduction to Laser Printer Service course. We will emphasize the service resources for troubleshooting the Personal LaserWriter printer. Troubleshooting Perform hands-on troubleshooting when **Process** You cannot resolve the customer's laser printer problem over the telephone and vou must 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 Begin hands-on troubleshooting by verifying the deviation from normal operation. You Normal Operation 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/ When you have an accurate problem description, you are ready to take actions to **Resolution Actions** 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. After you identify and replace a faulty part, you must thoroughly test the laser printer to Verify Problem Resolution verify the repair. Testing is essential for several reasons. First, you may have identified the faulty component, but you may not have identified all the faulty parts. Second, the problem may reappear when you repeat the actions that originally caused the problem.

Hands-On Troubleshooting

Third, some problems are intermittent and may not immediately reappear. Test the laser printer by following these steps before you return it to the customer. 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 Five service resources are available to help you perform Personal LaserWriter hands-on troubleshooting: Apple Service Source (February 1996 or later) and Companion CD Apple Service Guide for LaserWriter Printers, Volume I LaserWriter II Test Connector Technical Info Library Apple Service Internet website at http://service.info.apple.com 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 one of the LaserWriter LS, LS/L, NT, NTR, or SC models from the printer product list that appears. You are now in the Personal LaserWriter manual of Apple Service Source that addresses those particular models. (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 Personal LaserWriter manual window to go to the Flowchart section in the Troubleshooting chapter. The Flowchart will usually be the most useful section to you when troubleshooting. "Personal LaserWriter Flowchart" is an interactive file that guides you through a comprehensive check of the Personal LaserWriter SC/NT/NTR or the Personal LaserWriter LS and LS/L. After resolving the problem, use the Flowchart again as a first step in verifying problem resolution. Apple recommends that you also thoroughly test

the printer over a period of several hours.

Hands-On Troubleshooting

	If you have not carefully reviewed the Personal LaserWriter manual of <i>Service Source</i> , stop here and take time to do so now. You will use <i>Service Source</i> to complete the hands-on troubleshooting practice exercise and test later in this module. To successfully complete the module test, you must to accurately follow the troubleshooting procedures in <i>Service Source</i> .
Apple Service Guide	The <i>Apple Service Guide for LaserWriter Printers</i> volumes provide a subset of the most- often used procedures and information in <i>Service Source</i> and other laser printer service references. The Personal LaserWriter chapter in Volume I contains several helpful troubleshooting charts and procedures. This portable guide is especially helpful for on- site service calls when <i>Service Source</i> is not readily available.
	When using the <i>Apple Service Guide for LaserWriter Printers</i> Volume I, begin with Flowchart 1 in "Functional Check–LaserWriter SC/NT" or Flowchart 4 in "Functional Check–LaserWriter I.S," depending on the printer you are troubleshooting. The flowcharts refer you to other charts and tables. Like <i>Service Source</i> , the charts and tables present the steps for troubleshooting and repairing most deviations from normal operation.
LaserWriter II Test Connector	The LaserWriter II Test Connector (part number 077-8319) connects to the serial port on the Personal LaserWriter NT and NTR I/O PCBs. When you install the connector and switch on the printer, the printer LEDs display an error code, if an error exists. The flowcharts direct you when and how to use the LaserWriter II Test Connector.
Technical Info Library	The Technical Info Library (TIL), included with the <i>Apple Service Source</i> CD suite and also located on the Apple Service Internet website, is an excellent source of product troubleshooting information and may contain helpful tips that have not been added to either <i>Apple Service Source</i> or the <i>Apple Service Guide for LaserWriter Printers</i> . Look first on <i>Apple Service Source</i> or in the service guide. If you don't find the answer you need, check the TIL.
Apple Service Website	AppleService Internet website (http://service.info.apple.com) contains up-to-the-minute service information that may not yet have been added to <i>Service Source</i> CD or the <i>Apple Service Guides</i> . (For this month's logon and password, see your current <i>Service Source</i> CD.)
	These service resources are an essential part of your troubleshooting and repair tools. The more you use them, the more effectively and efficiently you will be able to troubleshoot and repair the Personal LaserWriter printer.

Continue with "Personal LaserWriter LS"—on the next page.

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Personal LaserWriter LS

The Personal LaserWriter LS and LS/L printers are the least expensive members of the Personal LaserWriter family. Troubleshooting the Personal LaserWriter LS and LS/L is different from troubleshooting the Personal LaserWriter NT and SC because of several design differences presented below.

The Personal LaserWriter LS does not produce a user test page, so you must print a service test page to determine if the I/O PCB or print engine is faulty. Also, the LEDs do not provide the same diagnostic information as the Personal Laser NT and SC. The Personal LaserWriter LS does provide diagnostic information not available with the Personal LaserWriter NT, NTR, and SC. The Personal LaserWriter LS printer driver has built-in error messages that indicate different hardware failures. For example, if there is a problem with the fuser assembly, the user may receive a fuser assembly malfunction error message. To verify a deviation from normal operation with the Personal LaserWriter LS, always attempt to print from a Macintosh computer to activate any error messages.

Use the same service resources to troubleshoot and repair the Personal LaserWriter LS and LS/L printer including *Service Source* and the *Apple Service Guide for LaserWriter Printers*, Volume I. Begin hands-on troubleshooting with the service guide using Flowchart 4—"Functional Check – LaserWriter LS."

Continue with Practice Exercise 1 on the next page.

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 workbook will be used later by other technicians.)

- 1. You are troubleshooting a Personal LaserWriter. What is the first troubleshooting action you should take?
- 2. You are troubleshooting a Personal LaserWriter LS at the customer's location. Which *Apple Service Guide for LaserWriter Printers* flowchart should you use?
- 3. You are using Flowchart 2—"Print Engine Check–LaserWriter SC/NT" in the Apple Service Guide for LaserWriter Printers, Volume I, while troubleshooting a Personal LaserWriter. The printer prints a service test page, but the print quality is poor. What should you do next?

- 4. You are troubleshooting a Personal LaserWriter LS. You have answered "yes" to every question in Flowchart 4 of "Functional Check–LaserWriter LS" in the *Apple Service Guide for LaserWriter Printerss*, Volume I. What should you do next?
- 5. You are troubleshooting a Personal LaserWriter NT print engine. You find that the paper-out and paper jam LEDs flash alternately. According to Flowchart 1 of "Functional Check—LaserWriter SC/NT" in the *Apple Service Guide for LaserWriter Printerss*, Volume I, what should you do next?

Practice Exercise 1

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- 6. You are unable to print from a Macintosh computer to a LaserWriter NT printer. Following the *Service Source* Flowchart procedures for a "Print Engine Check," you find that the printer has a toner cartridge and paper, that it is connected to a known-good Macintosh computer, and that the printer is switched on. The Ready LED lights steadily, the printer prints a user test page, and the print quality is fine. You still cannot print from the Macintosh computer. The Macintosh computer is correctly connected to the printer using LocalTalk. What should you do next?
- 7. You are using *Service Source* to troubleshoot and repair a Personal LaserWriter SC. Which chapter should you go to for assistance?
- 8. You are using the "Print Engine Check" in *Service Source* to repair a Personal LaserWriter NT. You install a toner cartridge and paper, connect the printer to a known-good Macintosh computer on a LocalTalk network, and switch on the printer. You find that the Ready LED does not light and that the paper-out and paper jam LEDs flash alternately. Next, you find that the DIP switch is set to 1. What should you do next?

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

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Practice Exercise 1 (Answers)

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

- 1. Verify the deviation from normal operation.
- 2. Flowchart 4 of "Functional Check-LaserWriter LS".
- 3. Go to Table H.
- 4. Go to Flowchart 6.
- 5. Go to Table C3.
- 6. Check that the DIP switch is set to zero (0).
- 7. Use the flowcharts in the Troubleshooting chapter.
- 8. Set the DIP switch to zero (0).

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. You may want to review the module and the practice exercises before starting the test.

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*. You must correctly answer 80 percent of the questions to pass Part 1. (Note: Write your answers on a separate piece of paper if this workbook will be used later by other technicians.)

- 1. Which of the following flowcharts in the *Apple Service Guide for LaserWriter Printers*, Volume I, should you use when you begin troubleshooting a Personal LaserWriter LS?
 - A. Flowchart 1
 - B. Flowchart 3
 - C. Flowchart 4
 - D. Flowchart 7
 - E. Flowchart 8
- 2. You are using Flowchart 1 of "Functional Check–LaserWriter SC/NT" in the *Apple Service Guide for LaserWriter Printers*, Volume I, and find that the paper jam LED is on. What should you do next?
 - A. Go to Table C.
 - B. Go to Table H.
 - C Go to Table B.
 - D. Go to Table K.
 - E. Go to Table J.
- 3. You are using Flowchart 4 of "Functional Check–LaserWriter LS" in the *Apple Service Guide for LaserWriter Printers* Volume I, to troubleshoot a Personal LaserWriter LS printer. You find that the fan is operational, the fuser lamp goes on and off, but the main motor does not rotate. What should you do next?
 - A. Go to Table A.
 - B. Go to Table D.
 - C. Go to Flowchart 5.
 - D. Go to Flowchart 3.
 - E. Go to Table E.

Module Test–Part 1

- 4. You are using Flowchart 6 in the *Apple Service Guide for LaserWriter Printers*, Volume I, to troubleshoot a Personal LaserWriter LS printer. You replace the I/O PCB and connect the printer to a Macintosh computer. The printer prints a copy of the directory, but the print quality is poor. What should you do next?
 - A. Go to Table C1.
 - B. Go to Table J.
 - C. Go to Table D.
 - D. Go to Table K.
 - E. Go to Table H.
- 5. You are repairing a Personal LaserWriter NT that prints solid black pages. Following the Flowchart procedures in *Service Source*, you replace the toner cartridge and the problem remains. What should you do next?
 - A. Install a second cartridge.
 - B. Check the voltage across pin J206-6 on the DC controller.
 - C. Check the voltage to the laser diode at J202-4.
 - D. Visually inspect connector J203.
 - E. Replace the high-voltage power supply.
- 6. Which manual, chapter, and section of *Service Source* should you use when troubleshooting and repairing a Personal LaserWriter SC?
 - A. Personal LaserWriter, Troubleshooting, Flowcharts
 - B. LaserWriters, Personal LaserWriter, Symptom Charts
 - C. LaserWriters, Personal LaserWriter, Specifications
 - D. LaserWriters, Personal LaserWriter, Basics
- 7. You are troubleshooting a Personal LaserWriter NT printer using the Flowcharts "Print Engine Check" in *Service Source*. Everything checks out until you find that the printer does not print a startup/user test page. What should you do next?
 - A. Use the LaserWriter II test connector.
 - B. Go to the I/O PCB submenu.
 - C. Replace the toner cartridge.
 - D. See if the I/O DIP switch is set to zero.
 - E. Print a service test page.

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

Module Test–Part 1 (Answers)

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Compare your Module Test-Part 1 answers with those below.

C
 D
 B
 E
 B
 A
 A

If you missed any items, review the module before you go on to the final exercise and test.

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Hands-On Troubleshooting Practice

Directions

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

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

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

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

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

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

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

Hands-On Troubleshooting Practice

	11000103100	and repair record
	Your Name	
	Laser Printer to Be Repaired	
	Deviation from Normal Operation	
	Repair Solution	
	Directions: Provide the information requested above. C Action" sections for each action you take. Be	Complete the "Action Taken" and "Reason for Taking the every specific.
1	Action Taken	Reason for Taking the Action
2		
3		
4		
5		
6		
U		

Figure 3-1 Troubleshooting and Repair Record form

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Module Test–Part 2

Directions

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

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

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

When you have successfully repaired two Personal LaserWriter printers according to the Troubleshooting Criteria, you have successfully completed the Personal LaserWriter SC/NT/LS Service Training Course. Congratulations!

Troubleshooting Criteria

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

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

You can correctly indicate whether this repair involved an exchange module
LASER PRINTERS SERVICE COURSE

Personal LaserWriter Wiring Diagram





Apple Personal LaserWriter NT & SC Wiring Diagram APPLE PERSONAL LASERWRITER NT & SC & LS TROUBLESHOOTING-OT & SC WIRING DIAGRAM 1/25/91 REV. FROM 6/8/90 SR



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