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Electrical Shock Hazard

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Conventions

This manual uses the following conventions:

Unless specifically stated otherwise, information applies to all four printer models (LaserJet 4L/4ML/4P/4MP). Most procedures are combined for all printers, except where they differ substantially.

Color is used to emphasize items which are important to the material under discussion.

The names of major printer parts and assemblies are Capitalized.

Bold is used for emphasis, particularly in situations where *italic* type would be confusing.

Italic type is used to indicate related documents or emphasis.

COMPUTER type indicates text as seen on a computer monitor.

DISPLAY type indicates text as seen on the printer's 16 character LCD display panel (LaserJet 4P/4MP only).

KEYFACE indicates keys on a computer keyboard or on the printer's control panel (LaserJet 4P/4MP only). Examples include **Enter** and **On Line**.

NOTE Notes contain important information set off from the text.

CAUTION Caution messages alert you to the possibility of damage to equipment or loss of data.

WARNING! Warning messages alert you to the possibility of personal injury.

A detailed matrix of printer features is followed by general information on the four printer models. Specifications, major assembly locations, safety and regulatory information are all included. The chapter ends with a discussion of the service and repair philosophy along with useful information on obtaining technical help.

Recommendations pertaining to the physical location of the printer and consumables are followed by general print media specifications (including specifications for paper, envelopes, labels and transparencies).

Chapter 3 provides the step-by-step installation and setup procedure, along with detailed information on using the Control Panel for each printer model. Sample self tests and printer reset information are also included.

Turn to this chapter for information on routine printer maintenance, including consumables and printer cleaning procedures. Paper jam procedures are also included.

Here you will find the basic theory-of-operation information required to understand the various printer systems and how they function together.

This chapter contains the step-by-step procedures for replacing all the printer's field replaceable units (FRUs). Assemblies are grouped by physical location in the printer.

Turn to Chapter 7 for diagnosing and troubleshooting printer problems. Start with the general troubleshooting flowchart, referencing the paper path and printer component location diagrams for assistance. Error message tables and image defect samples are followed by engine test and other diagnostic procedures. The chapter ends with more troubleshooting tools such as an image defect ruler and wiring diagram.

Use Chapter 8 to find any field replaceable unit (FRU) in the printers. Exploded view drawings are accompanied by complete part number and description tables.

The parts index is a convenient tool for looking up any field replaceable unit (FRU). All parts are sorted both by part number and by part name. Parts are cross-referenced to their corresponding exploded view illustrations in Chapter 8.

This appendix contains cabling and pin-out information for the serial, parallel and LocalTalk interfaces which are supported by the printers.

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Appendix A

Parts Index

Appendix B

I/O Information

Subject Index

1

Product Information

Printer Features

Features	LaserJet 4L (C2003A)	LaserJet 4ML (C2015A)	LaserJet 4P (C2005A)	LaserJet 4MP (C2040A)
Print Speed	4 ppm	4 ppm	4 ppm	4 ppm
Text & Graphics Resolution	300 dpi; plus Res Enhancement technology (REt)	300 dpi; plus Res Enhancement technology (REt)	600 dpi; plus Res Enhancement technology (REt)	600 dpi; plus Res Enhancement technology (REt)
Printer Language(s) **Standard** **Optional**[1]	Enhanced PCL 5 None	Enhanced PCL 5 PostScript Level 2 None	Enhanced PCL 5 PS L2 (with SIMM +4 Mb opt. memory)[1]	Enhanced PCL 5 PostScript Level 2 None
Monthly Usage (pages)	Up to 8000	Up to 8000	Up to 8000	Up to 8000
Memory: **Standard**[2] **Optional (maximum)**[1]	1 Mbyte 1 Mbyte module	2 Mbyte None	2 Mbyte Three 8 Mb SIMMs	6 Mbyte Two 8 Mb SIMMs
Input Tray Capacity	100	100	250	250
Output Tray Capacity	50	50	100	100
Envelope Capacity (manual)	1	1	1	1
Internal Typefaces	26 PCL	45 PCL, 35 PS	45 PCL	45 PCL, 35 PS
Cartridge Slots	0	0	1	0
Standard Interfaces	Parallel (Bi-tronics)	Parallel (Bi-tronics) LocalTalk	Serial (9 pin) Parallel (Bi-tronics)	Serial (9 pin) Parallel (Bi-tronics) LocalTalk
Power Control	Intelligent On/Off	Intelligent On/Off	Power switch	Power switch
NVRAM	No	Yes	Yes	Yes
Control Panel	1 Button, 4 LEDs	1 Button, 4 LEDs	8 Keys 16 char display 3 LEDs	8 Keys 16 char display 3 LEDs
EconoMode (toner saving)	Yes	Yes	Yes	Yes
Min. Paper Size (using flat paper path)	3 x 6.75 inch (76 x 171 mm)	3 x 6.75 in (76 x171 mm)	3 x 5 inch (76 x 127 mm)	3 x 5 inch (76 x 127 mm)

1 See "Accessories & Supplies" in Chapter 8 for option product numbers.
2 Printer memory is optimized with Memory Enhancement Technology (MEt).

Identification

Model and Serial Numbers

The model number and serial numbers are listed on identification labels located on the rear of the printer. The model number is alphanumeric, such as C2003A for the HP LaserJet 4L.

The serial number contains information about the Country of Origin, the Revision Level, the Production Code, and production number of the printer.

The rear labels also contain power rating and regulatory information as shown in Figure 1-1.

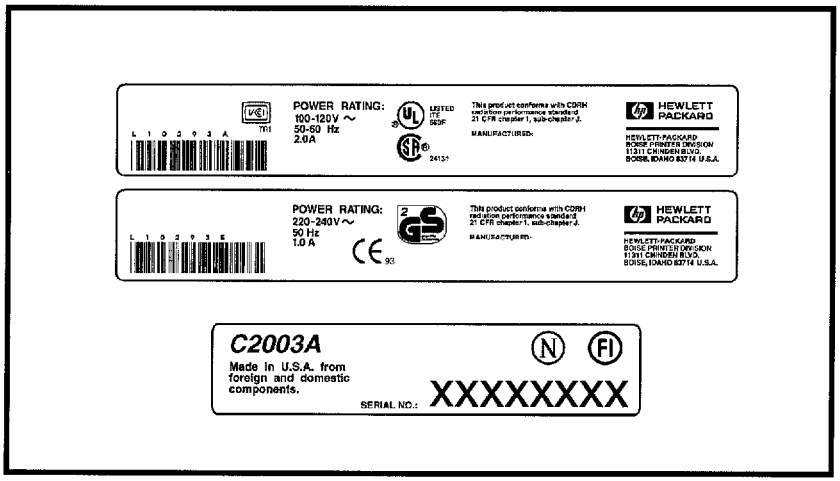


Figure 1-1 Sample Model and Serial Number Labels

Specifications

Table 1-1 Printer Dimensions

Dimension	LaserJet 4L/4ML (C2003A/C2015A)	LaserJet 4P/4MP (C2005A/C2040A)
Width	36 cm (14.25 in.)	40 cm (15.75 in.)
Depth	37 cm (14.5 in.)	39 cm (15.5 in.)
Height	16.5 cm (6.5 in.)	18 cm (7 in.)

Table 1-2 Performance Specifications

CATEGORY	SPECIFICATION
Print Speed *	Up to 4 pages per minute
Monthly Usage (Duty Cycle)	Up to 8000 pages
Life Expectancy of toner cartridge**	Approximately 3000 pages
First Print	Approximately 34 seconds

*Actual speed depends on data complexity and software handling efficiency.
**Toner cartridge life can be extended by using EconoMode.

Table 1-4 Electrical Specifications

VOLTS	FREQ	AMPS*	WATTS (typical)	
			4L/4ML	4P/4MP
120 Vac ± 10% 100 Vac ± 10%	50/60 Hz ± 2 Hz 50/60 Hz ± 2 Hz	3.6	printing = 180 standby = 5/7.5	printing = 180 standby = 10
220 Vac ± 10% 240Vac ± 10%	50/60 Hz ± 2 Hz 50/60 Hz ± 2 Hz	1.8	printing = 180 standby = 5/7.5	printing =180 standby = 10

*Operating current requirements.

Table 1-3 Environmental Specifications

Operating Environment		**Temperature:** 10° C to 32.5° C (50° F to 90.5° F) **Humidity:** 20-80% (no condensation)			
Storage Environment (not including toner cartridge)		**Temperature:** -20° to 60° C (-4° to 140°F) **Humidity:** 15-90% (no condensation)			
Acoustic Emissions		**4L**	**4P**	**4ML**	**4MP**
Operation position (per ISO 9296, DIN 45635,T.19):					
Printing	L_{PA} dB(A)	<48	<49	<51	<49
Standby	L_{PA} dB(A)	<22	<33	<22	<31
Bystander 1m (per ISO 7779, DIN 45635,T.19):					
Printing	L_{PA} dB(A)	<45	<46	<47	<46
Standby	L_{PA} dB(A)	<22	<30	<22	<29
Sound Power (per ISO 9296):					
Printing	L_{PA} dB(A)	<5.9	<6.0	<6.1	<6.0
Standby	L_{PA} dB(A)	<3.5	<4.4	<3.6	<4.4

Product Overview

External Assembly Locations (LaserJet 4L/4ML)

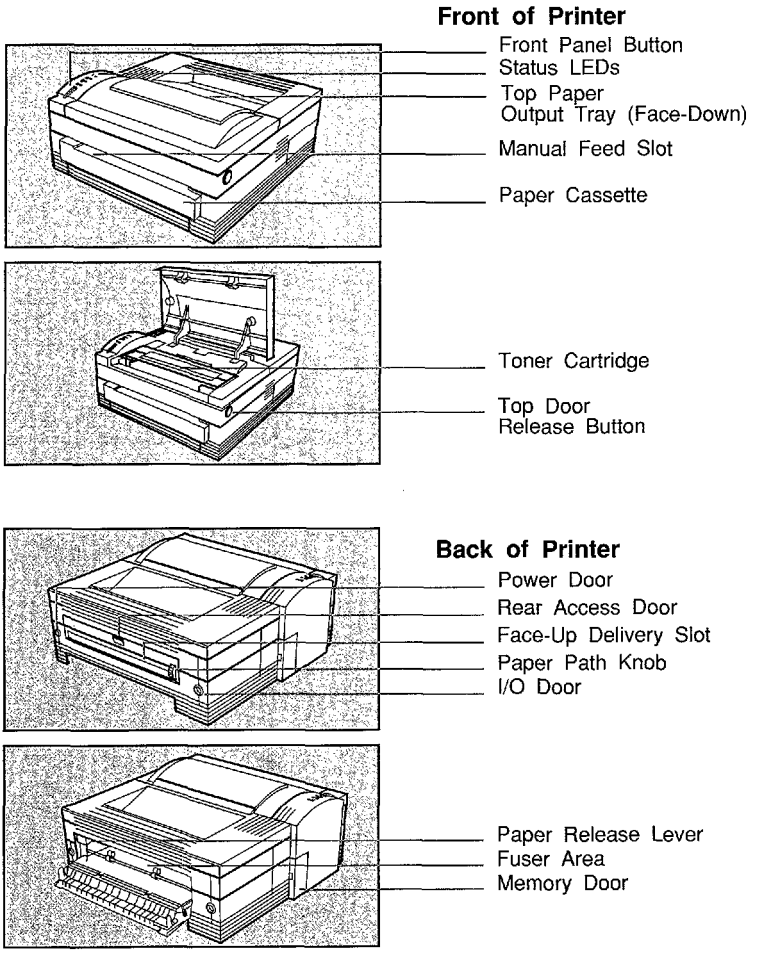


Figure 1-2 External Assembly Locations, LaserJet 4L/4ML

External Assembly Locations (LaserJet 4P/4MP)

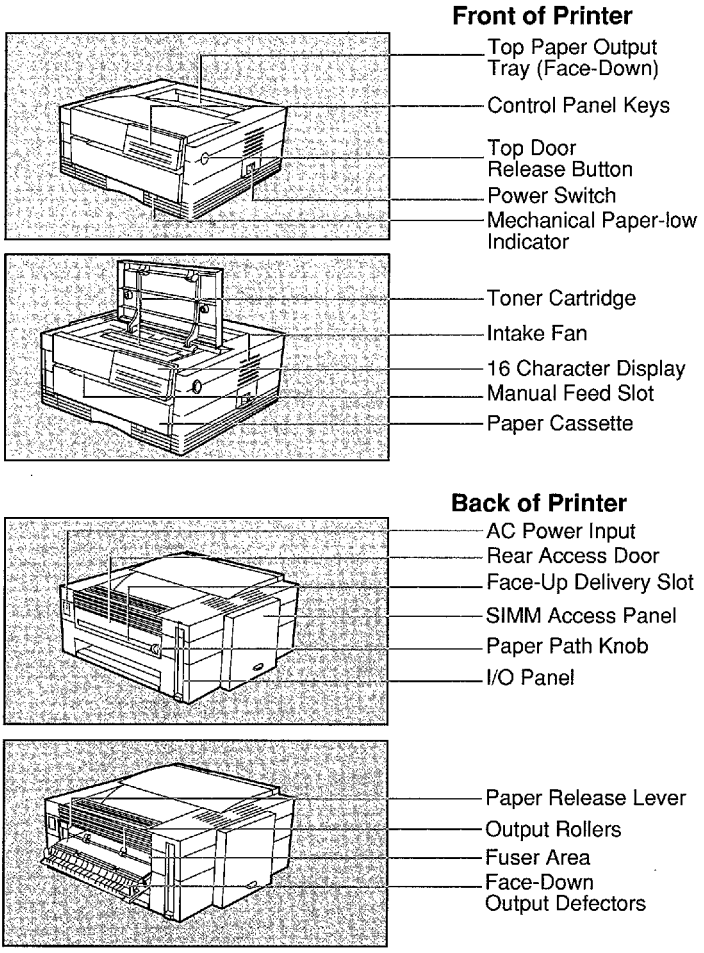


Figure 1-3 External Assembly Locations, LaserJet 4P/4MP

Internal Assembly Locations

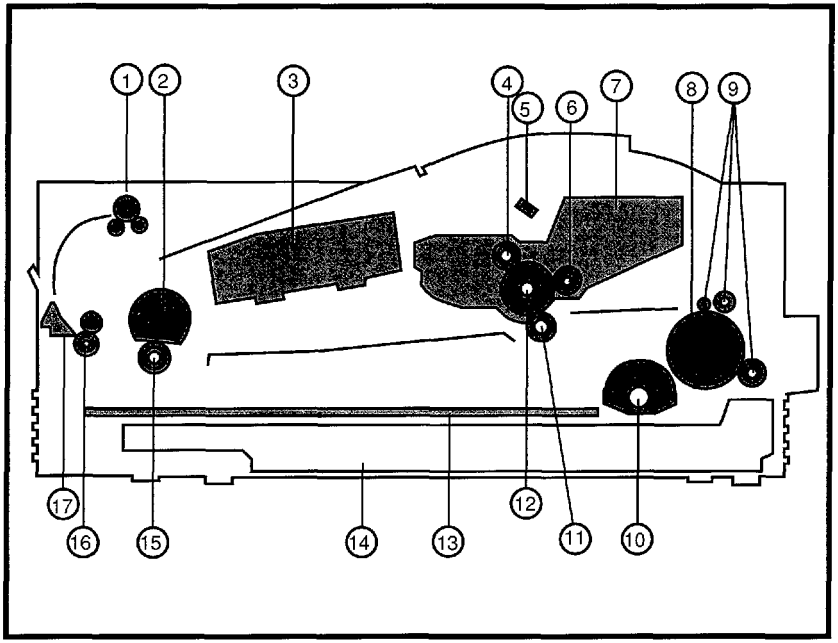


Figure 1-4 Internal Assembly Locations (all printers)

1. Face-Down Output Rollers
2. Upper Fusing Assembly
3. Laser/Scanner Assembly
4. Primary Charging Roller
5. Beam-to-Drum Mirror
6. Developing Cylinder
7. Toner Cartridge
8. Registration Roller
9. Oblique Rollers
10. Pickup Feed D-Roller
11. Transfer Roller Assembly
12. Photosensitive Drum
13. DC Controller PCA
14. Paper Cassette
15. Fusing Pressure Roller
16. Face-up Delivery Roller
17. Face-Up/Face-Down Deflector

Figure 1-5 shows the location of assemblies visible from the top of the **LaserJet 4L** printer with the printer cover removed.

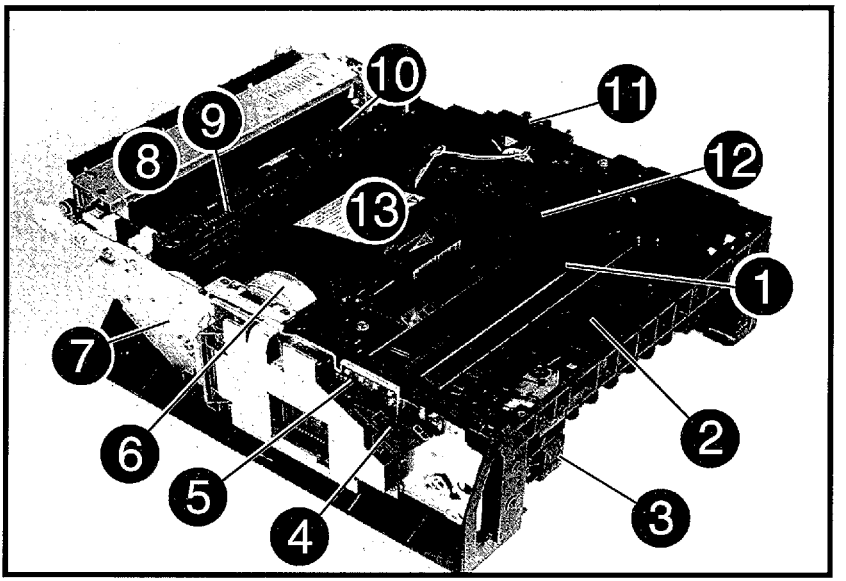


Figure 1-5 LaserJet 4L Internal Assembly Locations

1. Transfer Roller
2. Paper Guide/Top Oblique Roller
3. Front Oblique Roller
4. Switch Actuator
5. Formatter PCA
6. Main Motor
7. Gear Train Assembly
8. Fusing Assembly
9. Lower Output Rollers (Face-Down)
10. Upper Output Rollers (Face-Down)
11. Fan (FM1)
12. Beam-to-Drum Mirror
13. Laser/Scanner Assembly

Figure 1-6 shows the location of assemblies visible from the top of the **LaserJet 4P** printer with the printer cover removed.

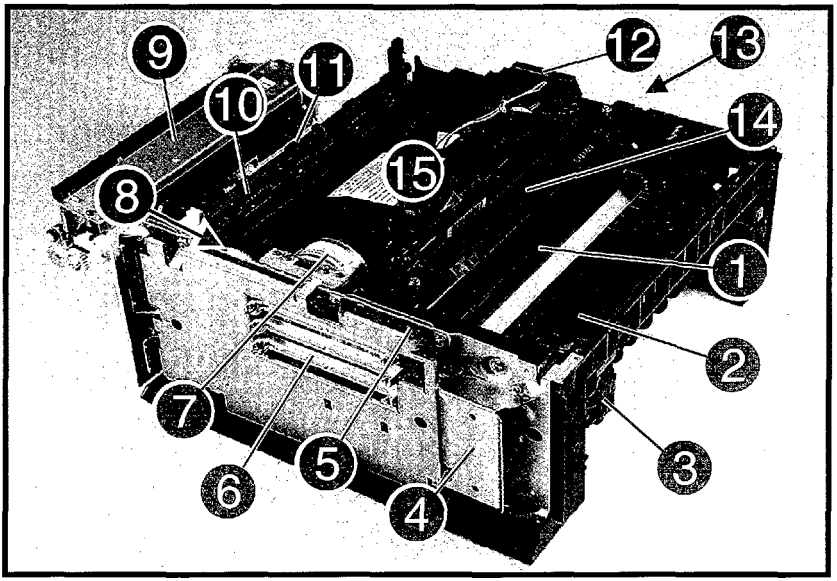


Figure 1-6 LaserJet 4P Internal Assembly Locations

1. Transfer Roller
2. Paper Guide/Top Oblique Roller
3. Front Oblique Roller
4. Cartridge Bracket
5. Formatter PCA
6. SIMM Slots (3)
7. Main Motor
8. Gear Train Assembly
9. Fusing Assembly
10. Lower Output Rollers (Face-Down)
11. Upper Output Rollers (Face-Down)
12. Fan (FM1)
13. Power Switch (not shown)
14. Beam-to-Drum Mirror
15. Laser/Scanner Assembly

Safety Information

Laser Safety

The Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products manufactured since August 1, 1976. Compliance is mandatory for products marketed in the United States.

This printer is certified as a "Class 1" laser product under the U.S. Department of Health and Human Services (DHHS) Radiation Performance Standard according to the Radiation Control for Health and Safety Act of 1968. Since radiation emitted inside this printer is completely confined within protective housings and external covers, the laser beam cannot escape during any phase of normal user operation.

WARNING! Never operate or service the printer with the protective cover removed from the Laser/Scanner Assembly. The reflected beam, although invisible, can damage your eyes.

Laser Statement (Finland)

The following applies to printer operation and servicing in Finland.

LASERTURVALLISUUS

LUOKAN 1 LASERLAITE
KLASS 1 LASER APPARAT

HP LaserJet(s) 4L, 4ML, 4P & 4MP laserkirjoitin on käyttäjän kannalta turvallinen luokan 1 laserlaite. Normaalissa käytössä kirjoittimen suojakotelointi estää lasersäteen pääsyn laitteen ulkopuolelle.

Kirjoittimen on hyväksynyt Suomessa laserturvallisuuden osalta Sähkötarkastuskeskus. Laitteen turvallisuusluokka on määritetty valtioneuvoston päätöksen N:o 472/1985 ja standardin EN 60825 (1991) mukaisesti.

VAROITUS ! Laitteen käyttäminen muulla kuin käyttöohjeessa mainitulla tavalla saattaa altistaa käyttäjän turvallisuusluokan 1 ylittävälle näkymättömälle lasersäteilylle.

VARNING ! Om apparaten används på annat sätt än i bruksanvisning specificerats, kan användaren utsättas för osynlig laserstrålning, som överskrider gränsen för laserklass 1.

HUOLTO HP LaserJet(s) 4L, 4ML, 4P & 4MP -kirjoittimen sisällä ei ole käyttäjän huollettavissa olevia kohteita. Laitteen saa avata ja huoltaa ainoastaan sen huoltamiseen koulutettu henkilö. Tällaiseksi huoltotoimenpiteeksi ei katsota väriainekasetin vaihtamista, paperiradan puhdistusta tai muita käyttäjän käsikirjassa lueteltuja, käyttäjän tehtäväksi tarkoitettuja ylläpitotoimia, jotka voidaan suorittaa ilman erikoistyökaluja.

VARO ! Mikäli kirjoittimen suojakotelo avataan, olet alttiina näkymättömälle lasersäteilylle laitteen ollessa toiminnassa. Älä katso säteeseen.

VARNING ! Om laserprinterns skyddshölje öppnas då apparaten är i funktion, utsättas användaren för osynlig laserstrålning. Betrakta ej strålen.

Tiedot laitteessa käytettävän laserdiodin säteilyominaisuuksista:

Aallonpituus 777-795 nm
Teho 5 mW
Luokan 3B laser

Declaration of Conformity

According to ISO/IEC Guide 22 and EN 45014:

Manufacturer's Name:	Hewlett-Packard Company
Manufacturer's Address:	11311 Chinden Boulevard Boise, Idaho 83714-1021, USA

declares, that the product

Product Name(s):	LaserJet 4L/4ML/4P/4MP
Model Number(s):	C2003A, C2015A, C2005A, C2040A
Product Options:	All

conforms to the following Product Specifications:

Safety: EN 60950:1988 + A1,A2
IEC 825:1984 + A1:1990 laser class 1

EMC: CISPR-22:1985 / EN 55022:1988 class B[1)]
EN 50082-1:1992
IEC 801-2:1991 / prEN55024-2:1992 - 3kV CD, 8 kV AD
IEC 801-3:1984 / prEN55024-3:1991 - 3V/m
IEC 801-4:1988 / prEN55024-4:1992 - 1 kV Power lines

Supplementary Information:
The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

[1)] The product was tested in a typical configuration with Hewlett-Packard Personal Computer and Test Systems.

Office of Quality Manager
Boise, Idaho USA
June 15, 1993

European Contact: Your Local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ / Standards Europe, Herrenberger Strae 130, D-7030 Bblingen (FAX: + 49-7031-14-3143)

Toner Safety

Note In case of toner spills, skin and clothing are best cleaned by removing as much toner as possible with a dry tissue, then washing with cold water. Hot water causes toner to permanently set into clothing.

MSDS Information

A Material Safety Data Sheet (MSDS) for toner or any other chemical used in the printer is available through Hewlett-Packard's Customer Information Center by either mail or fax.

By mail:

To obtain an MSDS for the HP 92274A toner cartridges through the mail, call the Customer Information Center (CIC) at 1-800-752-0900 between 6 A.M. and 5 P.M. Pacific Standard Time.

By fax:

To obtain an MSDS for the HP 92274A toner cartridges by fax, call HP ASAP (Automated Support Access Program) at 1-800-333-1917 and follow the instructions for using the HP FIRST fax service.

Note See "Technical Assistance" later in this chapter for more information on the HP FIRST service.

Ozone Emission

These printers do not use high voltage corona wires in the electrophotographic process, and therefore generate no measurable ozone gas (O_3). The printers instead use charging rollers in the toner cartridge and in the print engine.

FCC Statement (Class B)

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by Hewlett-Packard could void the user's authority to operate this equipment.

Note Use of a shielded interface cable is required to comply within the Class B limits in Part 15 of FCC rules.

VCCI Statement (Japan)

The VCCI statement below is required in Japan. It is similar to the FCC regulatory statement.

この装置は，第二種情報装置（住宅地域又はその隣接した地域において使用されるべき情報装置）で住宅地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会（VCCI）基準に適合しております。

しかし，本装置をラジオ，テレビジョン受信機に近接してご使用になると，受信障害の原因となることがあります。

取扱説明書に従って正しい取り扱いをして下さい。

Service Approach

Repair of the printer normally begins with use of the printer's internal diagnostics in conjunction with the troubleshooting procedures in Chapter 7. Once a faulty part is located, repair is accomplished generally by assembly-level replacement of Field Replaceable Units (FRUs). Some mechanical parts may be repaired at the sub-assembly. PCA component replacement is not supported by HP. Part numbers for all FRUs are located in Chapter 8 of this manual.

Exchange Program

HP offers remanufactured assemblies for some selected parts. These are identified in Chapter 8 and can be ordered through HP's Parts Direct Ordering, or Parts Center Europe (PCE).

Ordering Parts

Field replaceable part numbers are found in Chapter 8 of this manual. Replacement parts may be ordered from HP's Parts Direct Ordering, or Parts Center Europe (PCE). Adresses and phone numbers for both organizations are also found in Chapter 8.

Ordering Consumables

Consumables may be ordered directly from Hewlett-Packard. The phone numbers for ordering consumables are found in Chapter 8.

Ordering Related Documentation

Table 1-5 shows where to order related documentation. Phone numbers for the various sources are:

- **PDO (Parts Direct Ordering)**
  1-800-227-8164 (U.S. only)

- **PCE (Parts Center Europe)**
  (49 7031) 14-2253.

- **HP's Distribution Center (HPD)**
  303-353-7650 (U.S. only)

Table 1-5 Related Documentation

DESCRIPTION	PART NUMBER	PDO	PCE	HPD
HP LaserJet Family Quick Reference Service Guide	5961-0531	X	X	
HP LaserJet 4L User's Manual[1]	C2003-90901	X	X	
HP LaserJet 4ML User's Manual[1]	C2015-90901	X	X	
HP LaserJet 4P User's Manual[1]	C2005-90943	X	X	
HP LaserJet 4MP User's Manual[1]	C2040-90912	X	X	
HP PCL5 Printer Language Technical Reference Information Package	5961-0601	X	X	
HP LaserJet Printer Family Paper Specifications Guide	5002-1801			X
HP LaserJet 4L Software Solutions Pkg.[1]	C2003-60122			X
HP LaserJet 4ML Windows Solutions Pkg.[1]	C2015-60101			X
HP LaserJet 4ML Macintosh Solutions Pkg.[1]	C2015-60113			X
HP LaserJet 4P Software Pack[1]	C2005-60107			X
HP LaserJet 4MP Software Pack[1, 2]	C2040-60101			X

1 Shipped with printer. (English version part number is shown. Other translations are available - see your local HP Sales Office.)
2 Includes DOS, Windows and Macintosh solutions.

Print Utilities

HP provides several utilities for enhancing use of the LaserJet printers in DOS, MS Windows, and Macintosh environments. More information on specific utilities is included with each of the software packs listed in Table 1-5.

Technical Assistance

HP ASAP 1-800-333-1917 (U.S.)

HP ASAP (Automated Support Access Program) provides free technical support information 24 hours a day, 7 days a week. The ASAP system includes HP FIRST and HP AUDIO-TIPS, both explained below. The ASAP service requires a touch-tone phone.

HP FIRST

HP FIRST (Fax Information Retrieval Support Technology) is a phone-in fax service providing technical information for HP LaserJet users as well as service personnel. Receiving a fax requires a group 3 facsimile machine or fax card. Service-related information includes:

- Service notes (HP Authorized dealers).
- Application notes.
- Product Data Sheets.
- Material Safety Data Sheets (MSDS).
- Typeface and accessory information.
- Printer support software information.
- Toner information.
- Driver request form and Software Matrix.

HP FIRST, U.S.

Call the HP ASAP system (1-800-333-1917) and follow the voice prompts to enter HP FIRST.

HP FIRST, Europe

Call HP FIRST at one of the following numbers:

U.K., 0800-96-02-71
Belgium (Dutch), 078-111906
Switzerland (German), 155-1527
Netherlands, 06-0222420
Germany, 0130-810061
Austria, 0660-8128
For English service outside the above countries, (31) 20-681-5792

HP AUDIO-TIPS

HP AUDIO-TIPS, available within HP ASAP, is an interactive voice response system providing pre-recorded answers to the questions most frequently asked by HP LaserJet printer users. Helpful "System Maps" to the HP AUDIO-TIPS recordings are available by fax through HP FIRST.

HP CompuServe Forum

CompuServe members can download a variety of support materials including product data sheets, software application notes, and printer drivers for many popular software applications. Members may also post and reply to questions in an interactive format. To access the HP Forum, type GO HPPER at any prompt. For more information, or to join CompuServe, call 1-800-524-3388.

Customer Information Centers

For further technical assistance, service-authorized HP and dealer service personnel can contact the nearest Hewlett-Packard Customer Information Center, 1-800-752-0900 in North America.

Customer Support Center (Assist Line)

The HP Customer Support Center, (208-323-2551) is available to answer technical questions regarding setup, configuration, installation and operation of HP printers in the PC and Macintosh environments. The CSC Assist Line is available weekdays from 7 AM to 6 PM Mountain Time (Wednesdays until 4 PM).

Questions relating to operating systems such as MS-DOS and UNIX, your network configuration, or network operating system cannot be answered by the Center and should be referred to your authorized reseller.

European Customer Support Center

The HP European Customer Support Center, located in Amsterdam, Holland, is open from 8:30 am to 6:00 pm central European time (Wednesdays until 4:00 pm). Multilingual customer support representatives can answer technical questions similar to the U.S. CSC, described on the previous page. This service is available at no charge for a period equivalent to the original HP hardware warranty period.

Each time you call the HP European Customer Support Center, you will be required to provide the printer's serial number and original date of purchase.

To receive a fax listing the supported languages on a countries' phone number, call HP FIRST (refer to "HP FIRST," earlier in this section). You can also call the nearest HP sales and service office to obtain the telephone number for the Center. The Center features automated call-routing technology, so you will receive faster service if calling from a touchtone phone or tone dialer.

Other Areas

Outside of North America and Europe, contact your local HP sales office for assistance in obtaining technical support.

2

Operating Requirements

Site Requirements

Operating Environment

The environmental specifications listed in the "Specifications" section of Chapter 1 must be maintained to ensure the proper operation of this printer. Consider the following points before installing the printer:

- Install in a **well-ventilated, dust-free** area. (Excess dust or smoke will contaminate the printer's Beam-to-Drum mirror, affecting print quality.)
- Install on a **hard, flat and continuous surface,** with all four printer feet level. Do not install on carpet or other soft surfaces.
- Ensure **adequate power supply circuitry.** Printer current requirements can be found under "Specifications," in Chapter 1.

  Lighting Flicker: In an effort to reduce energy consumption, the fuser is turned on only when needed during printing. During standby mode, the fuser is not kept warm. When the printer is installed in a home, the instant-on fuser may cause some house lights to flicker when printing. This phenomenon is seen in many instant-on products, such as copiers, and will NOT affect printing, nor will it harm the electrical system in any way.

  To reduce a flicker effect, plug the printer into a different outlet that may be on a separate circuit, or try fluorescent lighting. If possible, add to the room's natural lighting. (Surge suppressers will not prevent flickering lights.)
- Install where there is **stable temperature and humidity,** with no abrupt changes (away from water sources, humidifiers, air conditioners, refrigerators, or other major appliances).
- Install **away from direct sunlight,** open flames, or ammonia fumes. If the printer is placed near a window, make sure the window has a curtain or blind to block any direct sunlight.
- Install with enough **space around the printer** for proper access and ventilation (see Figure 2-1).

Printer Space Requirements

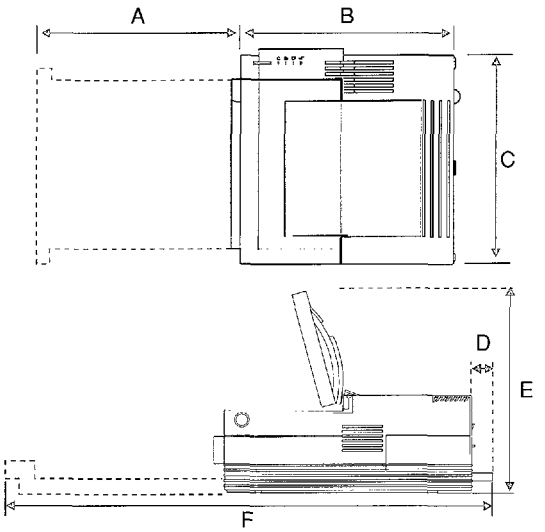


Figure 2-1 Printer Space Requirements

Table 2-1 Printer Operating Dimensions

Operating Dimensions	LaserJet 4L/4ML	LaserJet 4P/4MP
A (Tray)	14 inches (35.5 cm)	15 inches (38 cm)
B (Depth)	14.5 inches (37 cm)	15.5 inches (39 cm)
C (Width)	14.25 inches (36 cm)	15.75 inches (40 cm)
D (Rear Door)	2 inches (5 cm)	2 inches (5 cm)
E (Height - Top Door open))	13 inches (33 cm)	14 inches (35 cm)

The HP 92274A Toner Cartridge

Toner cartridges contain components which are sensitive to light, temperature, and humidity. Follow the recommendations in this section to ensure the highest quality and longest life of HP toner cartridges.

Table 2-2 Toner Cartridge Environmental Conditions

CATEGORY	TEMPERATURE	HUMIDITY
Operating	10° to 32.5° C (50° to 90.5° F)	35 to 85% RH
Storage	-20° to 40° C (-4° to 104° F)	15 to 90% RH

Storage Conditions

The toner cartridge is affected by its environment. Packaging protects the toner cartridge from light and increases its storage life. It is important to store the cartridge in its original packaging until the cartridge is ready to be installed in the printer.

When storing the toner cartridge in a warehouse or work area, make sure the storage place meets the conditions specified in Table 2-2.

Note The expiration date of the toner cartridge is stamped on the cartridge box. This date allows for up to $2\frac{1}{2}$ years after manufacture.

Storing Opened Toner Cartridges

Because the cartridge does not have a shutter to cover the laser beam access slot, it should be kept inside the printer until empty. Toner cartridges which have had the toner sealing tape removed are also more vulnerable to environmental extremes (such as high humidity).

If the toner cartridge must be removed from the printer, always store the cartridge:

- Inside the protective bag in which it was originally packaged.
- In a dark cabinet, away from direct sunlight.
- Correct side up and in a horizontal position (not standing on end).
- In a temperature between 10° and 35° C (50° - 95° F).
- Away from ammonia or other organic solvent fumes.

CAUTION Never ship the printer with a toner cartridge installed. Excessive vibration during shipping can cause toner to leak, contaminating the printer.

Never expose the toner cartridge to direct sunlight, or to room light for more than a few minutes. Bright light and direct sunlight can permanently damage a toner cartridge.

Toner Cartridge Handling Suggestions

- Before installing a cartridge, distribute the toner evenly by rotating the cartridge back and forth five to six times (see Figure 2-2). Repeat this action when toner begins to run low.

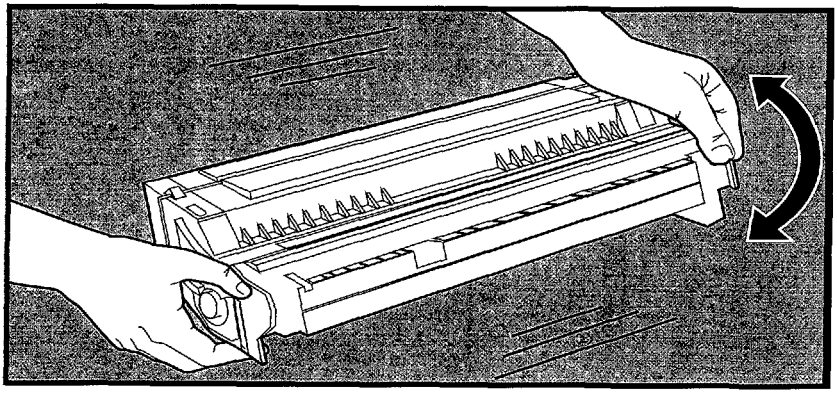


Figure 2-2 Distributing Toner

- Do not touch the surface of the photosensitive drum in the cartridge. Protect the drum from light and contamination.
- Do not disassemble or refill a toner cartridge.
- Do not expose the cartridge to unnecessary vibrations or shock.
- Do not expose the photosensitive drum to strong light. White areas on the page may indicate that the drum has been exposed to light for too long. If white areas appear, stop the printer and wait a few minutes. This process should eliminate most defective images. If not, the toner cartridge may be placed in a dark environment for an extended period of time, which may restore some life to the drum.
- Never manually rotate the drum, especially in the reverse direction; internal damage and toner spills may result.

Refilled Toner Cartridges

While Hewlett-Packard does not prohibit the use of refilled toner cartridges during the warranty period or while under a maintenance contract, **we do not recommend their use.** The reasons for this are:

- Hewlett-Packard has no control or process to ensure that a refilled toner cartridge functions at the high level of reliability of a new HP LaserJet toner cartridge. Hewlett-Packard also cannot predict what the long term reliability effect on the printer is from using different toner formulations found in refilled cartridges.

- Hewlett-Packard has no control over the actual print quality of a refilled toner cartridge. The print quality of HP LaserJet toner cartridges influences the customer's perception of the printer.

- Repairs resulting from the use of refilled toner cartridges are not covered under the HP warranty or maintenance contract.

Recycling Toner Cartridges

In order to reduce the amount of plastics and other wastes entering our landfills, Hewlett-Packard has established a program for recycling used toner cartridges. Parts that do not wear are re-used in manufacture of new cartridges. Plastic and other materials are recycled. HP pays the shipping costs. In addition, a one dollar donation is shared by the Nature Conservancy and the National Wildlife Federation for each cartridge returned under this program. To join this recycling effort, follow the instructions included inside each toner cartridge box.

Media Specifications

Several types of print media can be used with HP LaserJet printers, provided the media specifications are met. Using media that does not meet the specifications listed in this section may increase the incidence of paper jams, cause premature printer wear, and contribute to repair costs.

Note More detailed media specifications are available in the *HP LaserJet Printer Family Paper Specification Guide,* part number 5002-1801. To order additional copies, refer to "Ordering Related Documentation" in Chapter 1.

It is possible that print media can meet all of the general specifications listed and still not print satisfactorily because of the printing environment or other variables over which Hewlett-Packard has no control.

Hewlett-Packard neither warrants nor recommends the use of any particular media brand. Properties are subject to change by manufacturers and HP has no control over such changes. The operator should test particular media prior to large purchases.

All media should be stable at the 392° F / 200° C temperatures encountered in the printer's fusing process.

CAUTION Use only media recommended for use in laser printers. Printer damage resulting from use of incompatible media will not be covered by HP warranty or service agreements.

Media Sizes Supported

The following media sizes are supported by the printer's paper cassette and manual feed slot.

Table 2-3 Supported Media Sizes

Sizes	LaserJet 4L/4ML		LaserJet 4P/4MP	
	Universal Cassette	Manual Feed	Universal Cassette	Manual Feed
Minimum size:* 3 x 7.5 in. (76 x 190 mm) 3 x 5 in. (76 x 127 mm)		X*		X* X*
Letter, 8.5 x 11 in. (216 x 279 mm)	X	X	X	X
Legal, 8.5 x 14 in. (216 x 356 mm)	X	X	X	X
Exec, 7.25 x 10.5 in. (184 x 267 mm)	X	X	X	X
A4, 210 x 297 mm (8.27 x 11.69 in.)	X	X	X	X
Envelopes: Com-10, 4.1 x 9.5 in. (105 x 241 mm) Monarch, 3.87 x 7.5 in. (98 x 191 mm) DL, 110 x 220 mm (4.3 x 8.6 in.) C5, 162 x 229 mm (6.4 x 9 in.)		X* X* X* X*		X* X* X* X*

* Use the "flat paper path" only (manual feed and **rear output**).

Media Selection Guidelines

To achieve the best possible print quality and avoid paper jams, follow these guidelines for selecting paper:

- Use only high quality, copier grade paper. Avoid paper with embossed lettering, perforations, or texture that is too smooth or too rough.

- Colored paper should be of the same high quality as white photocopy paper. The pigments must withstand the printer's fusing temperature of 392° F (200° C) for 0.1 second without deterioration. Do not use paper with a colored coating that was added after the paper was produced.

- Pre-printed forms must be printed with non-flammable, heat-resistant inks that do not melt, vaporize, or release hazardous emissions when subject to the printer's approximately 392° F (200° C) fusing temperature for 0.1 second.

- Always test a small sample of a new print media before purchasing large quantities.

- Give a copy of the table on the next page to your paper vendor to ensure that the paper you purchase meets the specifications for this printer. More detailed specifications are in the *HP LaserJet Printer Family Paper Specification Guide,* HP Part No. 5002-1801. (See "Ordering Related Documentation" in Chapter 1.)

Table 2-4 Selected Paper Specifications

Basis Weight	Paper Cassette: 16 to 28 pound (60 to 105 g/m2). Manual Feed Slot: 16 to 36 pound (60 to 135 g/m2).*
Finishing Precision	Cut sheet to within 0.3 inch (0.8 mm) of nominal, 0.20° square.
Furnish (Composition)	100% chemical wood pulp and/or cotton fiber.
Grain	Long grain.
Moisture Content	4.7 ±1% by weight .
Packaging	Polylaminated moisture proof ream wrap.
Smoothness	100 to 250 (Sheffield)*

* **LaserJet 4P/4MP only:** Heavier paper stock, in the range of 36 to 42 pound (135 to 158 g/m2) may be used, but must use the "flat paper path" (manual feed, rear output) and have a Sheffield smoothness rating not greater than 180.

Note

The "flat paper path" (manual feed slot and rear face-up delivery door) is recommended for envelopes, overhead transparencies, and labels.

Envelope Specifications

Choose envelopes that are well-constructed. They should lay flat and be sharply creased. They should not be wrinkled, nicked, or otherwise damaged. Envelopes with a peel-off adhesive strip, or more than one fold-over flap to seal, must use adhesives compatible with the heat and pressure of the printer's fusing process. When printing envelopes, always use the "flat paper path" (manual feed slot and the rear face-up delivery door).

CAUTION To prevent severe printer damage, do not use envelopes having windows, clasps, snaps, or synthetic materials.

Table 2-5 Envelope Specifications

Paper	Paper used for envelope construction must meet the requirements in the table under "Media Selection Guidelines."
Basis Weight	20 to 24 pound (75 to 90 g/m2), single thickness
Caliper	3.3 to 5.5 mils (0.084 to 0.14 mm), single thickness
Curl (Pre-printed)	Envelopes must lay flat with no more than 0.2 in. (5 mm) curl across the entire surface.
Finishing	Envelopes must not have any adhesive exposed to the printer. They must be folded accurately, within ± 0.04" (1 mm). There must be no more than two thicknesses of paper anywhere along the leading edge. All folds must be well scored and sharply creased, and construction must be tight (not baggy). Envelopes must not be stuck together with excess seam gum.
Furnish (Composition)	100% chemical wood pulp and/or cotton fiber.
Fusing Compatibility	Must not scorch, melt, offset, or release hazardous emissions when heated to 392° F (200° C) for 0.1 second.
Grain	Long grain.
Moisture Content	4.7 ±1% by weight .
Smoothness	100 to 250 (Sheffield)

Adhesive Label Specifications

Use the following guidelines when selecting labels:

- The top sheet (printing surface) must be of copier quality and provide good toner adhesion.
- The carrier sheet (backing sheet) must be compatible with the temperatures and pressure of the fusing process, and must be coated for easy release of the top sheet.
- The adhesive must be stable at the 392° F (200° C) temperatures encountered for 0.1 second in the printer's fusing process, and must not produce emissions that exceed exposure levels or threshold limits established by OSHA and other safety agencies. Adhesives must not come into direct contact with any part of the printer.
- Labels must be arranged on the carrier sheet so that any exposed spaces run lengthwise down the sheet. Using label stock with spaces between the horizontal rows of labels can often result in labels peeling off during printing, causing serious jamming and possible printer damage.

A wide selection of suitable labels is available through Hewlett-Packard. A list of available sizes is in the HP LaserJet Printer Family Paper Specification Guide, HP Part No. 5002-1801. See Chapter 1 for ordering information, or contact your local authorized HP dealer.

CAUTION Do not attempt to print on label sheets after any of the labels have been removed from the sheet. Damage to the printer may result.

Table 2-6 Adhesive Label Specifications

Adhesive	Must not be on any external surfaces of the label before, during or after printing. Label construction and die-cutting must not allow labels to peel off during transport, printing, or fusing.
Caliper	Must not exceed 0.007 in. (0.19 mm)
Curl	In ream: flat within 0.2 in. (5 mm)
Finishing Precision	Cut sheet within 0.031 in. (0.79 mm) of nominal and 0.20° square.
Fusing Compatibility	All adhesives, carrier sheets, top sheets, and other materials used in label construction must be compatible with the heat and pressure of the fusing process. Materials must not discolor, melt, offset, or release hazardous emissions when heated to 392° F (200° C) for 0.1 second.
Packaging	Moisture proof wrap to preserve properties.

Note

The "flat paper path" (manual feed slot and rear face-up delivery door) is recommended for printing adhesive labels.

Transparency Specifications

Overhead transparencies used in HP LaserJet printers must be able to withstand the 392° F (200° C) temperatures encountered in the printer's fusing process for 0.1 second. Suitable transparency film is available through Hewlett-Packard. Refer to Chapter 3 of the *HP LaserJet Printer Family Paper Specification Guide,* HP Part No. 5002-1801 for details.

Caliper	3.9 to 4.3 mils (0.100 to 0.110 mm)
Cutting Angle	90° ± 0.2°
Finishing precision	Cut sheet to within 0.03 in. (0.8 mm) of nominal and ± 0.2° of square.
Fusing Compatibility	Overhead transparency material must be compatible with the heat and pressure of the fusing process. Materials must not discolor, melt, offset material, or release hazardous emissions when heated to 392° F (200° C) for 0.1 second.

The "flat paper path" (manual feed slot and rear face-up delivery door) is recommended for printing transparencies.

Storing Print Media

Follow these guidelines when stacking and storing print media:

- Store paper in its ream wrapper until ready to use.
- DO NOT store cartons or reams directly on the floor; place cartons on a pallet or on shelves.
- DO NOT store individual reams in a manner that causes them to curl or warp along the edges.
- Re-wrap partially used packages of media before storing.
- DO NOT stack more than six cartons on top of each other.
- Stack each carton squarely on top of the one underneath.
- Stack each carton upright.
- DO NOT place anything on top of media, regardless of whether the paper is packaged or unpackaged.
- Store envelopes in a protective box to avoid damaging the envelope edges.
- Keep stored media away from temperature and humidity extremes.
- DO NOT store printed documents in vinyl folders (which may contain plasticizers) or expose the documents to petroleum based solvents.

Shipping Print Media

When shipping print media through different environments, plastic wrap all cartons on the shipping pallet. When shipping media across bodies of water, wrap individual cartons as well. Packaging must protect the media from physical damage.

3

Installation and Configuration

Unpacking and Installation

Before unpacking the printer, inspect the shipping container for signs of physical damage. Since a damaged shipping box is an indication of improper handling during shipping, the printer may also be damaged.

Note If the shipping container has any sign of damage, unpack and power the printer ON with the carrier's agent present. If the printer appears damaged or fails self test, do not accept it.

A. Choose the best location.

Verify that the printer location meets all requirements listed in Chapter 2.

B. Unpack the printer.

1. Remove the power cord, the manuals, and the toner package.
2. Remove the printer from its box.
3. Remove the outer packing material from the printer.
4. Open the printer top door by pressing the door release button on the right side of the printer (see Chapter 1, Figure 1-2 or 1-3 for location).
5. Pull out the paper cassette.
6. Remove the packing spacers from the inside of printer (2 on the Transfer Roller) and from the paper cassette (2).

C. Check package contents.

Note — If any of the package contents are missing or damaged, contact your HP dealer immediately.

The package should include the following:

- Printer.
- Power cord.
- Software Solutions package.
- User's Manual.
- Toner cartridge.

Note — Interface cables are sold separately. Refer to Chapter 8 for part numbers.

D. Install the toner cartridge.

1. Press the top door release button to open its top door.

2. Remove toner cartridge from its box and cut it open. Save the packing materials for possible cartridge storage.

3. Shake the cartridge vigorously to distribute the toner evenly inside the cartridge (see Figure 2-2 in Chapter 2).

4. Grasp the toner sealing tape tab on the right side of the cartridge. Pull firmly to remove the strip of sealing tape.

5. Grasp the plastic cartridge body **(not the metal shutter linkage),** and slide the cartridge into the printer, pushing it firmly into place. Close the top door.

E. Load the paper cassette.

1. Pull out the paper cassette located at the lower front of printer and load approximately 100 sheets (4L/4ML) or 250 sheets (4P/4MP) of paper. The rear of the stack should fit loosely under the two backstops at the rear of the paper cassette.

2. Insert the front corner of the paper stack under the metal clip at the front of the cassette.

Note — Failure to insert the paper under the metal clip will cause skewing or paper jams.

3. Resting the paper cassette on a flat surface, slide it into the printer.

F. Attach the interface cable(s).

1. Open the I/O Door on the printer's left rear side (LaserJet 4L/4ML only). Attach the I/O cable securely to the printer.

Note — Failure to attach the cable securely may result in an I/O error.

2. LaserJet 4L/4ML: Align the cable with the cable hole and close the I/O Door.

3. Attach the I/O cable to the computer.

G. Attach the power cord.

1. LaserJet 4L/4ML: Open the Power Door at the right rear of the printer by pressing on the back end of the door and swinging it outward.

2. Connect the power cord. On the LaserJet 4P/4MP, turn on the power switch on the right side of the printer.

   All front panel lights briefly illuminate, then the green Ready light comes on. (LaserJet 4P/4MP: There is a brief self test period before the Ready and the On Line lights are illuminated and the display reads `00 READY`.)

3. LaserJet 4L/4ML: Align the power cord with the hole at the rear of the door and close the Power Door.

4. LaserJet 4L/4ML: Briefly press the front panel button to generate a self test and verify that the printer is working.

   LaserJet 4P/4MP: Press the **On Line** key, then Menu repeatedly until `TEST MENU` appears. Then press **Item** once to display `SELF TEST`. Press **Enter** to print a self test.

Note

Refer to the section "Printing a Self Test," later in this chapter, for a detailed description of self test information.

Note

Power On/Off: The LaserJet 4P/4MP uses a conventional on/off power switch. The LaserJet 4L and 4ML printers do not have a power switch, but use Intelligent On/Off sensing instead. (See "Intelligent On/Off" in Chapter 5.)

H. Attach the Help Labels (LaserJet 4L/4ML only)

Packaged with the *User's Manual* is a sheet of help labels. These labels explain the meanings of the front control panel lights.

Attach the large help label to the inside of the printer's top door, and the small label next to the front panel lights, as shown in Figure 3-1.

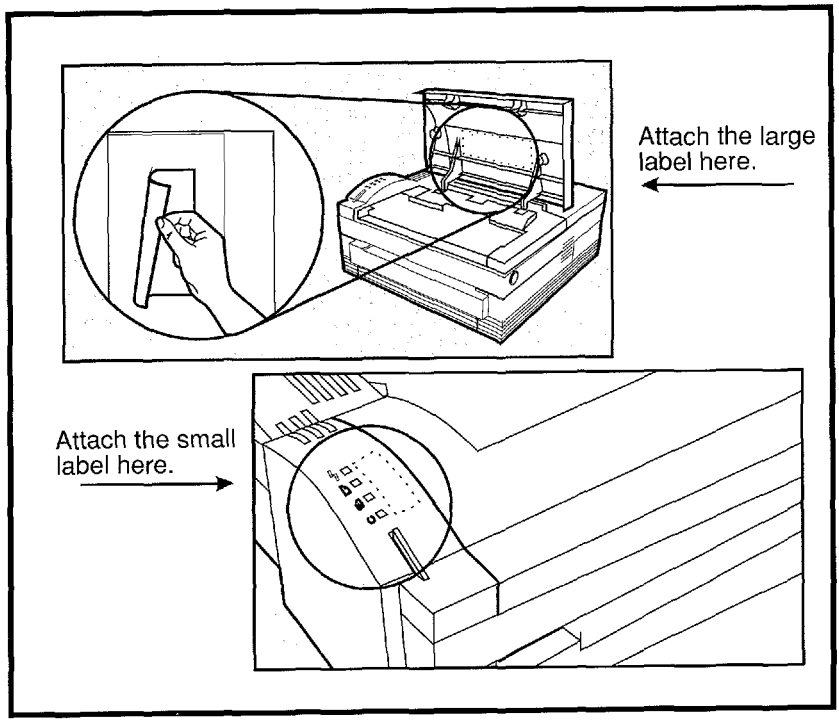


Figure 3-1 Attaching the Help Labels (LaserJet 4L/4ML)

I. Install Printer Drivers and Utilities (optional)

Printer drivers are specialized programs designed to allow specific software applications to function with the HP LaserJet printers. Printer utilities include such things as the HP Explorer program modules, which enhance the usability of the printer and provide convenient access to printer features outside of specific software applications.

How to Obtain Printer Drivers

First, check the software's printer selection feature to see if the printer is listed among the available printers. If it is not, run the software's SETUP or INSTALL program to install a "printer driver" or "printer file" for the printer.

Here are some ways to obtain printer drivers and Software Application Notes for HP LaserJet printers:

- Check the Printing Software package to see if it includes a driver for your software.
- Order an updated driver from the software vendor.
- Call Hewlett-Packard at 303-353-7650.
- Obtain a driver request form by fax through HP FIRST (call 1-800-333-1917).
- Download a driver through CompuServe's HP Forum. To sign up for CompuServe, call 1-800-848-8199.

Note

While waiting for a specific HP LaserJet printer driver, you can substitute a similar printer driver (such as a driver for the HP LaserJet III, IIIP, or 4 printer). These substitute drivers will allow you to use the printer, but they do not support all of the printer's features.

Using the Printing Software Package

The Printing Software package supplied with the printer provides many useful programs and utilities, including:

- Printer drivers for several popular software applications.
- Utilities for automatically copying printer drivers onto your hard disk.
- Software Application Notes for the above applications.
- The HP Explorer utilities, including:
  - A setup program which installs other HP Explorer modules and automatically updates the computer's AUTOEXEC.BAT and CONFIG.SYS files. Use the setup program to add or delete any of HP Explorer's utilities at any time.
  - The HP Explorer Remote Control Panel allows changes to printer settings from the computer's screen. It supplements the software's printer support to permit complete control over the printer's features.
  - The HP Explorer Status Monitor is a "Terminate-and-Stay-Resident" (TSR) program that automatically displays messages from the printer on the computer's screen whenever the printer's status changes.
  - The HP Explorer Travel Guide is a guide to the printer's features. It also serves as an on-line help utility when using other HP Explorer modules.

Using the Control Panel

LaserJet 4L/4ML Control Panel Overview

The HP LaserJet 4L/4ML printer's front control panel consists of 4 status lights and a front panel button situated on top of the printer.

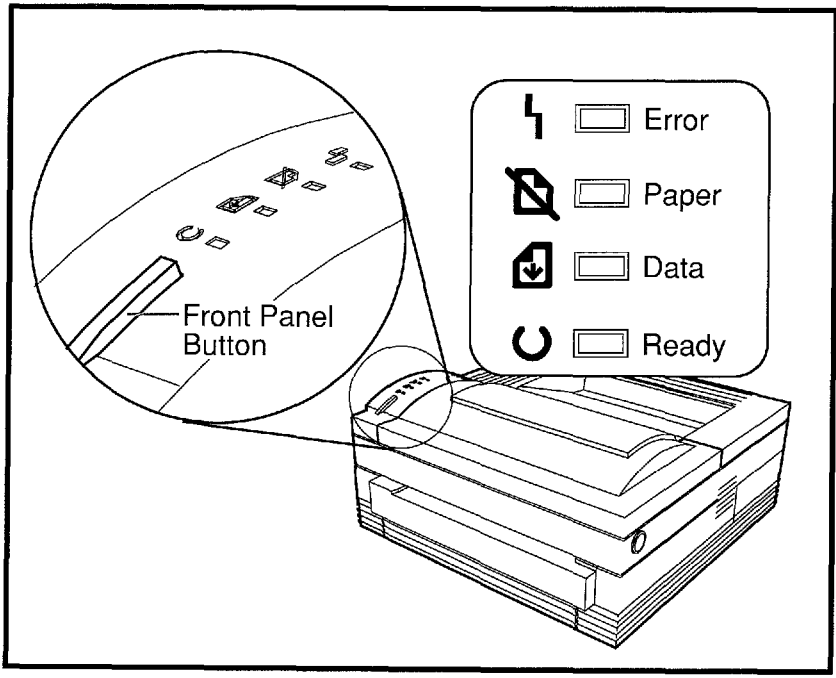
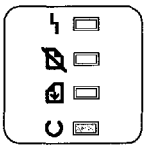


Figure 3-2 LaserJet 4L/4ML Front Control Panel

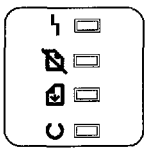
The LaserJet 4L/4ML Lights

The LED lights provide a quick way to check the printer's status.



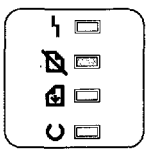
Ready (Green)

STEADY: The printer is ready to print a job from the paper cassette.
BLINKING: If this light is blinking and the Data light is on steadily, the printer is receiving or processing data.



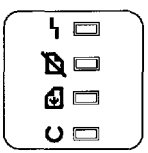
Data (Green)

STEADY: If the Data light is on steadily and the Ready light is blinking, the printer is receiving or processing data. If the Data light and the Ready light are both on steadily, there is unprinted data still in the printer. Briefly press the front panel button to print the remaining data.
BLINKING: The printer is in Manual Feed mode. Either insert a sheet of paper into the manual feed slot, or press the front panel button briefly to print from the paper cassette instead.



Paper (Amber)

STEADY: The paper cassette is empty or missing. Add more paper.
BLINKING: There is a paper jam. Jam locations include the paper cassette, under the toner cartridge, or inside the printer's rear access door. See Chapter 4 for clearing paper jams.



Error (Amber)

STEADY: The printer's top door is open or the toner cartridge is either missing or not installed correctly. To correct the problem, make sure the toner cartridge is installed completely and close the top cover until it snaps shut.
BLINKING: The page is too complex. Press the front panel button to continue printing. There may be some data loss on the page. Try setting Page Protect to On or Auto in the Printer Memory category of the HP Explorer Remote Control panel. If the page still doesn't print correctly, you may need to install the optional printer memory.

The LaserJet 4L/4ML Front Panel Button

Depending on what state the printer is in, pressing the front panel button allows for control of printing tasks by either starting or resuming a printer function. Table 3-1 explains front panel button usage.

Table 3-1 Front Panel Button Usage

FUNCTION	ACTION	Lights	RESULT
Self Test	Press button for two seconds.	READY light on briefly.	Prints a Self Test page.
Continuous Self Test	Hold down button while powering on printer (4L: about 5 seconds, 4ML: about 15 seconds).	All lights cycle through. Release button when DATA light only is on (4ML: all lights on).	Prints continuous self test pages. Press the button to stop printing.
Reset	Press button for five seconds or until lights are flashing in sequence.	Always available except when all lights are lit (Service Error).	Clears all data from memory, including unprinted data, downloaded fonts and macros. Resets printer to factory default settings.
Wake Up	Press button for two seconds.	All off.	Takes the printer out of Intelligent Off mode.
Continue	Press button for two seconds.	Any recoverable error code (see Chapter 7).	Allows the printer to recover and continue printing the job.
Form Feed	Press button for two seconds.	DATA and READY light on steady.	Print remaining data in printer memory.
Manual Override	Press button for two seconds.	DATA light blinking.	Override manual feed to print from paper cassette.
Service Error Codes	Hold down button to display code.	All lights on steady.	Press the button to display service light pattern. Use Chapter 7 to determine the problem and solution.

LaserJet 4P/4MP Control Panel Overview

The HP LaserJet 4P/4MP printer's front control panel consists of a 16 character backlit LCD display, an 8 key control panel, and 4 LED status lights situated on top of the printer.

To access a primary key function (such as On Line, Form Feed, or Menu) just press the appropriate key. To access secondary key functions (Reset, EconoMode and -), use the **Shift** key. For example, to access the "reset" function of the **Menu/Reset** key, press **Shift** and **Menu/Reset** simultaneously.

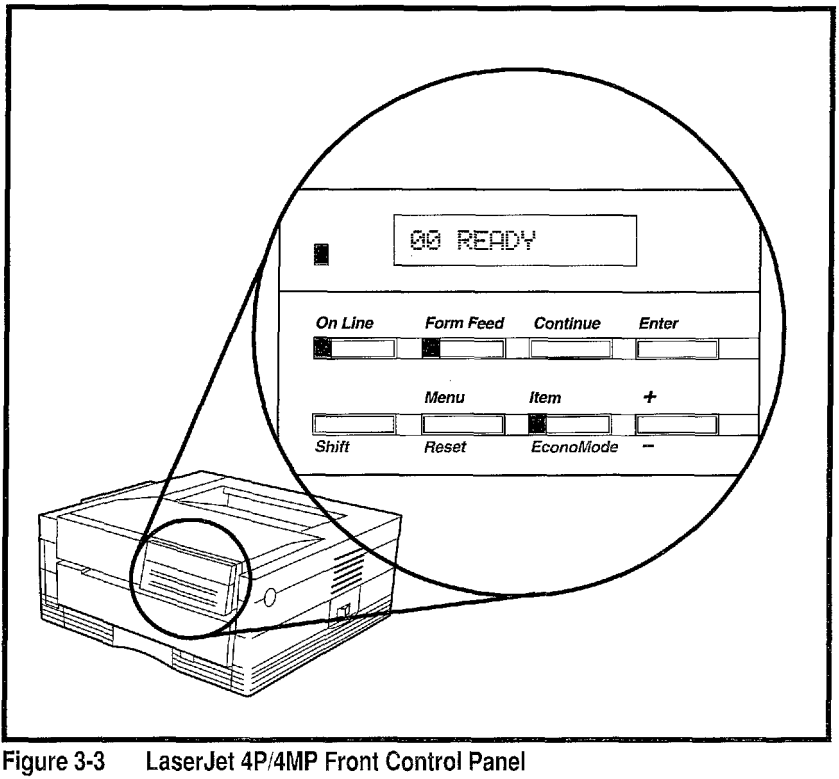
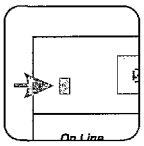


Figure 3-3 LaserJet 4P/4MP Front Control Panel

LaserJet 4P/4MP Control Panel Display and Lights

The printer's control panel has a 16 character backlit LCD message display area and four LED status indicator lights. A complete list of display panel messages is in Chapter 7. The following describes the functions of the four lights.

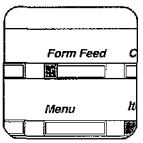


Ready Light

ON STEADY: There are no error conditions detected. The printer can only receive a print job when this light as well as the On Line light are on.
BLINKING: The printer is receiving or processing data. Do not take off line or switch power off until the light stops blinking.
OFF: The printer is not ready to print. Check the display panel for a message.

On Line Light

ON STEADY: The printer is ready to receive and process data.
BLINKING: The printer is transitioning from the On Line to Off Line status.
OFF: The printer is off line (not ready to receive data). Other control panel keys can now be accessed.



Form Feed Light

ON STEADY: There is unprinted data still in the print buffer. Press **On Line** to take the printer off line, then press **Form Feed** to print the remaining data.
BLINKING: Buffered data is being printed.
OFF: No buffered data is in the printer.

EconoMode Light

ON STEADY: EconoMode is on. This reduces the amount of toner used on the page. *NOTE: Software can override this selection, even while the EconoMode light is ON.*
OFF: EconoMode is off. To turn EconoMode on, press **On Line** to take the printer off line, then hold down **Shift** while pressing the EconoMode key.

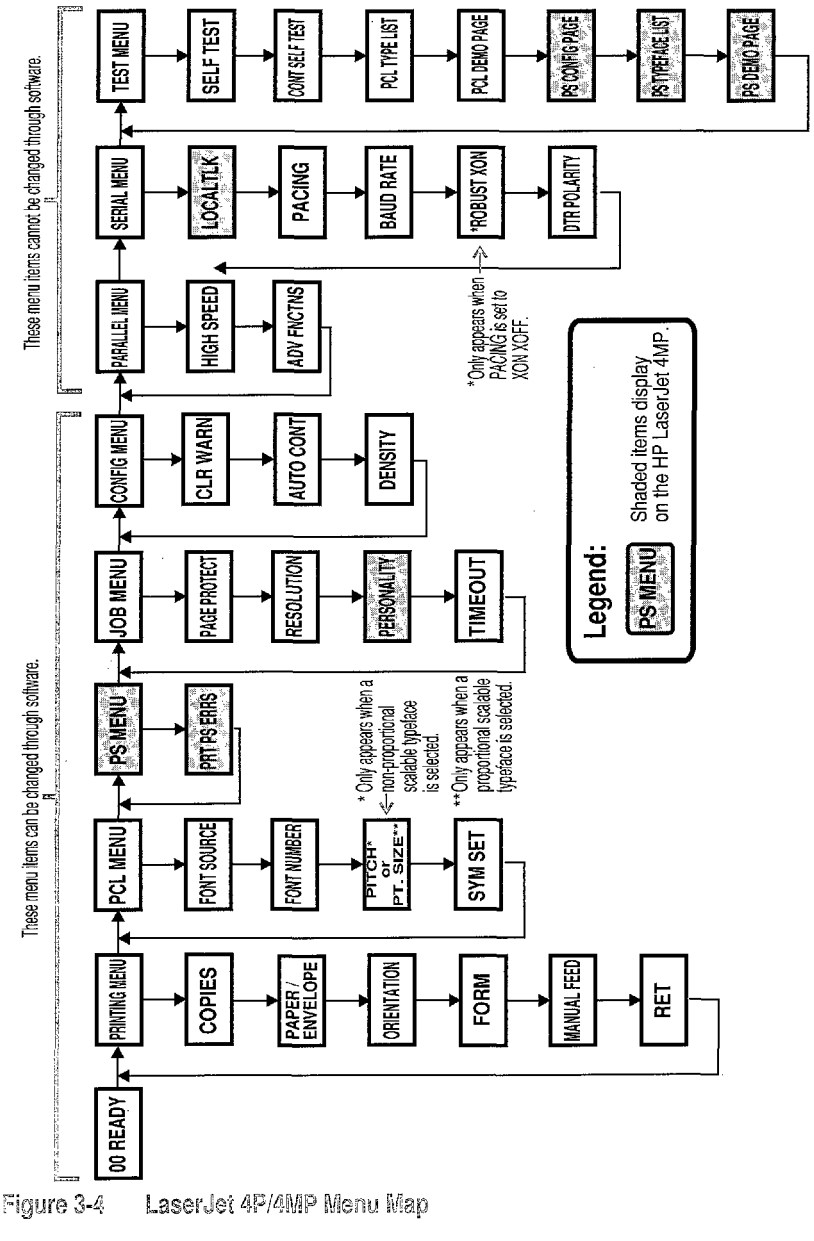


Figure 3-4 LaserJet 4P/4MP Menu Map

Service Mode (LaserJet 4ML/4P/4MP)

The Service Mode should be used only by authorized service personnel. While in Service Mode, you can:

- Print a Service Mode Self Test.
- Verify and set the Page Count (the page count also is displayed on the standard self test).
- Set the Cold Reset Default. (This sets the factory default paper size to either Letter or A4).
- Set the Demo Page=True/False. Used to remove the Demo Page option from the self test menu.
- Set the Diagnostic Functions ON or OFF (for software developers use only).

LaserJet 4ML

Since the HP LaserJet 4ML does not have a front control panel, Service Mode is accessible only through software (PJL commands). See "PJL Software Commands" later in this Chapter.

LaserJet 4P/4MP

The following procedure is used to initiate the Service Mode (refer to Figure 3-5).

1. Hold down the **On Line**, **Form Feed**, and **Enter** keys while powering ON the printer, until all lights are illuminated and the Display Window is blank. (If the Display Window reads `05 SELF TEST` at this point, the keys were released too soon. Repeat this step until successful.)

2. Click the **Form Feed** key, then the **Enter** key. The message `SERVICE MODE` is displayed briefly, then the printer automatically begins a `05 SELF TEST`. After several seconds, both Control Panel Indicators turn OFF. (The printer may display `02 WARMING UP` if it has not warmed up completely.) After the printer has warmed up and passed the self test, `SERVICE MODE` is displayed.

To exit the Service Mode press the **On Line** key.

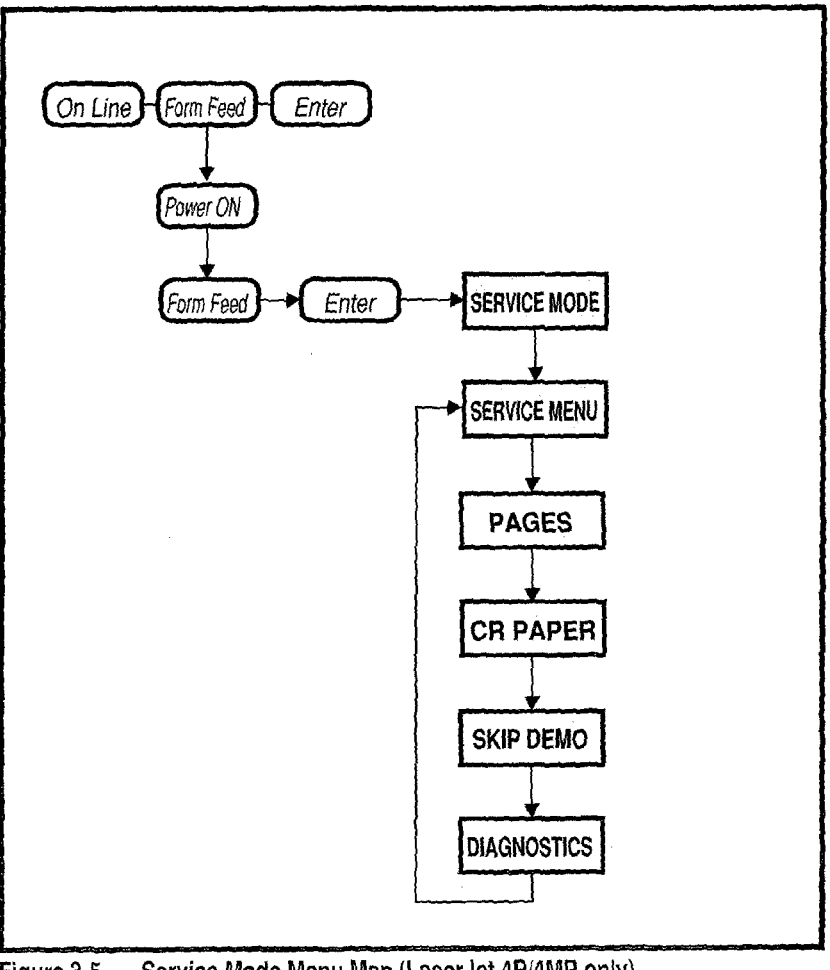


Figure 3-5 Service Mode Menu Map (LaserJet 4P/4MP only)

Setting the Page Count (LaserJet 4P/4MP)

The page count is stored in the printer's Non-Volatile Memory. If it is necessary to replace the Formatter PCA, the page count should be reset to the printer's original page count to reflect the age of the print engine. Use the following procedure to set the page count:

Before removing the old Formatter PCA, print a front panel self test to verify the current page count of the printer, if possible.

Note If it is not possible to print a self test, try to verify the page count before replacing the Formatter PCA by following steps 3 through 5, below.

After verifying the page count from the old Formatter PCA, replace it with the new PCA as described in Chapter 6.

1. Enter the Service Mode as described in this section.
2. When SERVICE MODE is displayed, press the **Menu** key to access the Service Menu.
3. Press the **Item** key to step through the menu. PAGES=*XXXXXX* is displayed.(*XXXXXX* represents the page count currently stored in the printer's Non-Volatile Memory. The underlined character denotes the cursor position.)
4. Press the **Enter** key to scroll the cursor to underline the desired digit.
5. Press the **-/+** key to select the correct value.
6. Press **Enter** to store the new value in NVRAM.
7. Set each digit in the same manner. Press **On Line** to return the display to SERVICE MODE.
8. Press **On Line** a second time to exit Service Mode.

Setting the Cold Reset Default (LaserJet 4P/4MP)

The default paper size for Formatter PCAs in Europe is A4. When replacing Formatters whose default is set for A4, set the Customization Variable to A4. When the Customization Variable is set to A4, the Cold Reset procedure will always reset the paper size to A4 (not to Letter).

To set the Customization Variable:

1. Enter the Service Mode as described in this section.
2. Press the **Menu** key to access the Service Menu.
3. Press the **Item** key to step through the menu until `CR PAPER=LETTER*` is displayed.
4. Press the **+/-** key to toggle between Letter and A4 paper.
5. Press the **Enter** key to save your selection.
6. Press **On Line** to return the display to `SERVICE MODE`.
7. Press **On Line** a second time to exit Service Mode.

Other Service Mode Items

The other Service Menu items, `SKIP DEMO=` and `DIAGNOSTICS=` are included for specialized purposes. If either item needs to be changed from the default setting (`FALSE` and `OFF`, respectively), the procedure is similar to that used for setting the page count or Cold Reset default, described above.

Printing a Self Test

LaserJet 4L/4ML:

1. Make sure the Ready light is on, and all other lights are off. (If necessary, reset the printer.)

2. Briefly press the front panel button (LaserJet 4ML, see Note below).

3. After about 6 seconds, the Data light blinks and the self test page starts to print (see Figure 3-6). Usually, only one page prints. If fonts or macros have been downloaded, a second page prints.

Note

LaserJet 4ML: The procedure above prints a "demo page" only on the LaserJet 4ML. To print PCL and PostScript configuration pages on the LaserJet 4ML, press and hold the front panel button down for at least 10 seconds, until the Data light is ON and the Ready light is blinking. Five pages will be printed (including font sample pages).

LaserJet 4P/4MP:

1. Press **On Line** to take the printer off line. The On Line light goes off and the display reads `00 OFFLINE`.

2. Press **Menu** repeatedly until `TEST MENU` is displayed.

3. Press **Item** to display `SELF TEST`.

4. Press **Enter**. The display panel reads `05 SELF TEST`. After a few minutes a PCL Configuration self test page is printed (see Figure 3-7).

Figure 3-6 shows a self test printout for the LaserJet 4L. It lists all factory default settings.

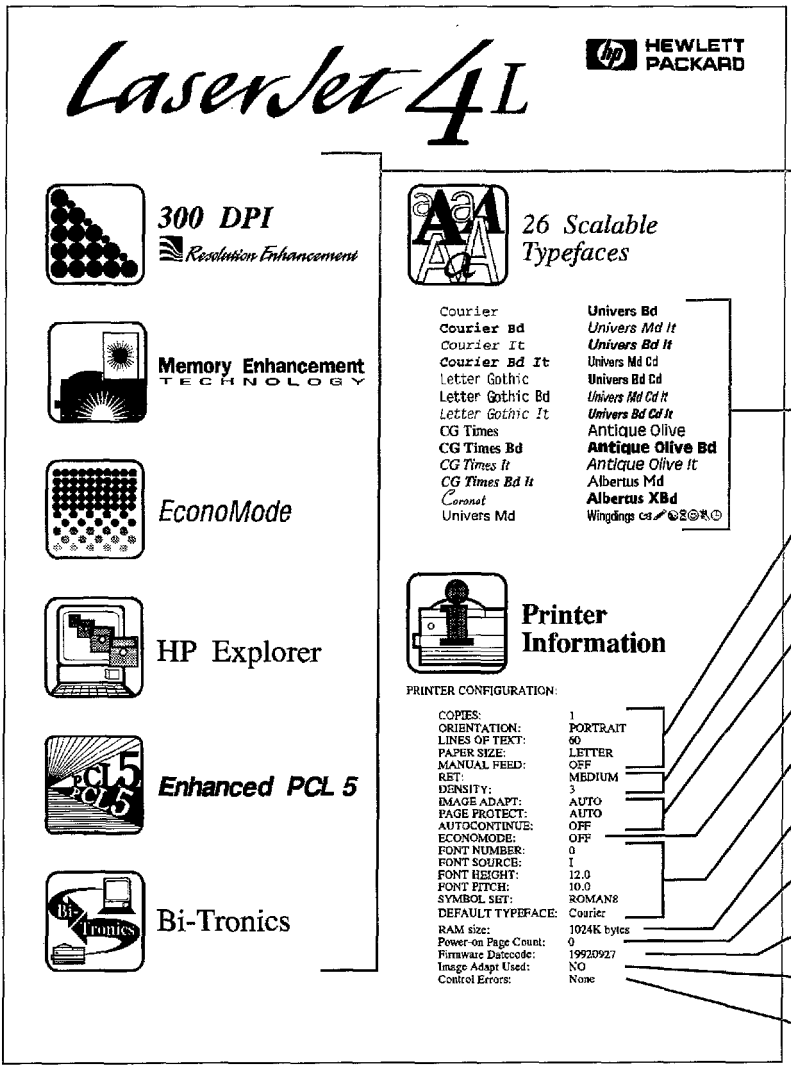


Figure 3-6 LaserJet 4L Self Test Page (showing default settings)

The LaserJet 4L Self Test Fields

1. **Printer Features List.** This area can be used to check for graphics print quality.

2. **Scalable Typeface List.** Samples of the printer's internal scalable typefaces.

Note — Removing ac power returns items 3 through 12 to factory default settings (shown in Figure 3-6).

3. **Paper Handling.** Shows the current paper settings.

4. **Print Quality Adjustment.** Current settings for print density and Resolution Enhancement (REt).

5. **Memory Configuration.** Settings for Image Adapt, Page Protection, and Auto Continue.

6. **EconoMode.** Setting of this toner-saving feature.

7. **Font Selection.** Current default printer font settings.

8. **RAM size.** Shows the total amount of installed printer memory, including added optional memory. Use to verify proper memory installation.

9. **Page Count.** Shows approximately how many pages have been printed since the last power on. This value is returned to zero whenever the printer is powered off.

10. **Firmware Datecode.** Shows the datecode of installed firmware in YYYYMMDD format.

11. **Image Adapt Status.** Displays YES if the Image Adapt data compression feature has been invoked since the last power on.

12. **Control Errors**. Shows the number of I/O or misprint errors since the last power on.

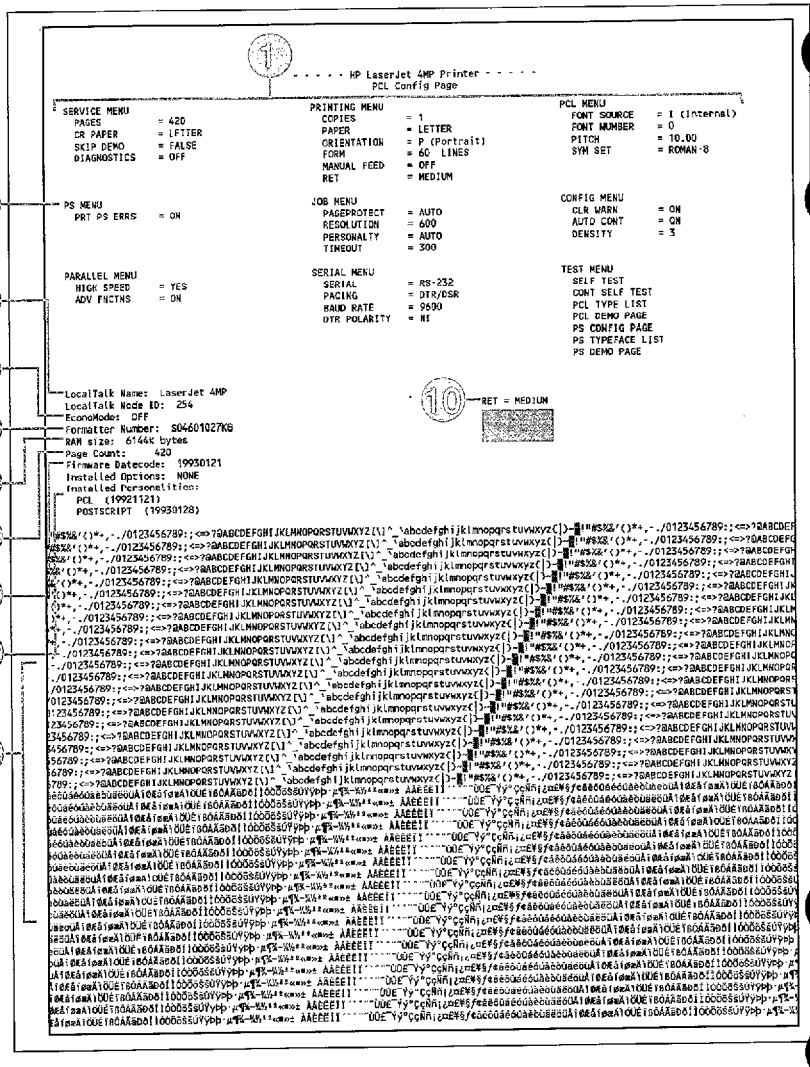


Figure 3-7 LaserJet 4MP Service Mode Self Test Page

The LaserJet 4ML/4P/4MP Self Test Fields

The numbered items below refer to the Service Mode PCL Configuration Self Test Page shown in Figure 3-7.

1. **Menu Selections:** Shows the current selections for all Service menu and user menus in the order that they appear in the control panel display (refer to the Menu Maps, Figures 3-4 and 3-5). Use this information to verify the various menu selections.

2. **PS Menu:** Appears on the LaserJet 4P only if the Adobe PostScript SIMM is installed.

3. **LocalTalk Information:** LaserJet 4MP only. Lists the configured network name and node identification number.

4. **EconoMode Status:** Shows current status, ON or OFF.

5. **Formatter Number:** Shows the Formatter PCA's serial number.

6. **RAM Size:** Shows how much memory is installed in the printer. 2048 Kbytes is standard. If optional memory has been added, a self test can be used to verify installation.

7. **Page Count:** Shows how many pages have been printed over the life of the printer.

8. **Firmware Datecode**: Shows the datecode of the installed firmware (in YYYYMMDD format).

9. **Installed Options/Personalities:** Lists recognized cartridges and personalities. Use to verify installation.

10. **REt Status:** Shows the current Resolution Enhancement setting, LIGHT, MEDIUM, DARK or OFF. (Default is MEDIUM.)

11. **Sample Print:** Shows ripple print pattern (always in Courier). This area is useful for checking print density and quality.

Continuous Self Test

A continuous self test can be useful for troubleshooting paper path and other problems. To print a continuous self test:

LaserJet 4L/4ML:

1. Disconnect the printer from the power source.

2. Press and hold down the front panel button while connecting power.

3. Continue holding the button for:
   4L - about five seconds; 4ML - about 15 seconds.

   All lights will illuminate at once, then:
   4L - each will light in sequence; 4ML - all lights stay lit.

4. Release the button. The printer conducts its internal diagnostics routine, then prints the self test page continuously until stopped.

5. To stop the continuous self test (and reset the printer), press and hold the front panel button for a few seconds until all lights begin lighting in sequence once again. (4ML - the printer can take up to 2 minutes to clear the buffer and stop the self test.)

LaserJet 4P/4MP:

1. Press **On Line** to take the printer off line. The On Line light goes off and the display reads `00 OFFLINE`.

2. Press **Menu** repeatedly until `TEST MENU` is displayed.

3. Press **Item** until `CONT SELF TEST` is displayed.

4. Press **Enter**. The display panel reads `04 SELF TEST`. After a few minutes a PCL Configuration self test page is printed (see Figure 3-7). The self test page will print multiple copies, continuing until the **On Line** or **Continue** key is pressed.

Engine Test

The engine test print can be used to verify that the print engine is functioning correctly. The Formatter PCA is completely bypassed during an engine test. This test is therefore useful for isolating printer problems. The engine test prints a full page of vertical lines down the entire printable area, and is thus also useful for checking and adjusting registration.

Note

An Engine Test can be performed on the LaserJet 4L and 4ML with the printer covers in place, as shown in Figure 3-8. The LaserJet 4P and 4MP require removal of the covers and the Formatter PCA. Refer to "Engine Test" in Chapter 7 for the engine test procedure.

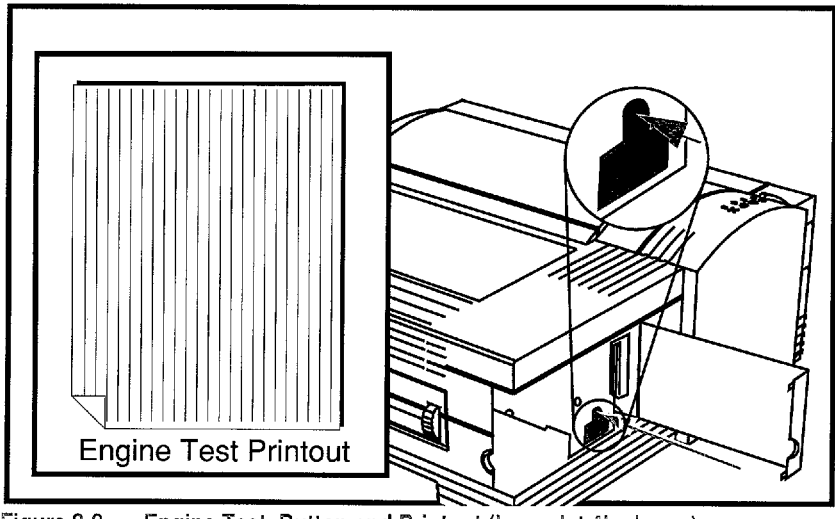


Figure 3-8 Engine Test Button and Printout (LaserJet 4L shown)

Resetting the Printer

Resetting the printer clears the printer's memory, including unprinted data, downloaded fonts, and macros. It also removes some error conditions, and resets to factory default settings. The printer can be reset at any time, except when there is a service error condition.

LaserJet 4L/4ML:

1. Hold the front panel button down for at least five seconds. Release when all lights illuminate in succession from bottom to top.
2. After the printer has finished the reset, the Ready light comes on (if there are no printer errors).

LaserJet 4P/4MP:

The LaserJet 4P/4MP has several kinds of resets, as explained below.

Simple Reset

A simple reset does the following:

- Clears the printer's page buffer.
- Removes all temporary typefaces and macros.
- Makes the current user-selected defaults "active" (making them the default values until you change them again).
- Purges the input buffer of the active I/O (the other I/O buffer is not affected).

To perform a simple reset:

1. Press **On Line** to take the printer off line. The On Line light goes off and `00 OFFLINE` appears on the display.
2. While holding down the **Shift** key, press **Reset** briefly.
3. `07 RESET` appears on the display. Then the printer returns to the on-line, `00 READY` state.

The Menu of Resets

Additional reset options are available through the Menu of Resets. Use the Menu of Resets option with caution. It can result in loss of buffered page data or printer configuration data. You should only use it when:

- You wish to restore the default printer settings.
- Communication between the printer and computer is interrupted.
- You are using both the serial and the parallel I/O ports, and one of the ports is having problems.

To access the Menu of Resets:

1. Press **On Line** to take the printer off line.
2. Hold down both the **Shift** and **Reset** keys for at least 10 seconds until RESET=MENU appears on the display.
3. Use **+** or **-** to cycle through the items.
4. Press **Enter** to select your choice of resets. An asterisk * appears by the reset option.
5. Press **On Line** to execute the reset.

The following table shows the three reset options.

Table 3-2 Menu of Resets (LaserJet 4P/4MP)

Menu Selection	Printer Response	Explanation
RESET=MENU	09 MENU RESET	RESET=MENU restores most of the printer's factory default settings. It also performs a simple reset. Items in the Config, Parallel, and Serial Menus are not reset. RESET=MENU clears only the active input buffer.
RESET=ACTIVE I/O	09 RESET ACTIVE I/O	RESET=ACTIVE I/O clears the input and output buffers for the *active I/O only,* and performs a simple reset.
RESET ALL I/O	09 RESET ALL I/O	RESET=ALL I/O clears the input and output buffers for *both I/Os,* and performs a simple reset.

The Cold Reset (LaserJet 4ML/4P/4MP)

Cold reset clears all data from the printer's memory and sets all the defaults back to the factory settings. (NOTE: The LaserJet 4L is effectively "cold reset" whenever power is removed.)

To perform a cold reset:

LaserJet 4ML:

Cold Reset can be performed on the LaserJet 4ML through the HP Explorer Utility (refer to the Software/Solutions package for instructions).

LaserJet 4P/4MP:

1. Turn off the printer.

2. While holding the **On Line** key down, turn the printer on. `08 COLD RESET` appears briefly on the display, then `05 SELF TEST` appears.

3. After about 30 seconds, `00 OFFLINE` appears on the display, and the cold reset is complete.

4. Press **On Line** to return the printer on line. `00 READY` appears on the display.

PJL Software Commands

Many of the control panel functions explained in this chapter can also be accessed through PJL software commands sent from the host computer. For the LaserJet 4ML printer, functions such as entering Service Mode, are accessible *only* through PJL commands. (Note that Service Mode is available only on the LaserJet 4ML, 4P and 4MP, and *not* on the LaserJet 4L.)

The following example shows how to use PJL commands to enter Service Mode and perform various Service Mode configuration tasks.

Note Text is CASE-sensitive in PJL; enter exactly as shown. The $^{E}_{C}$ symbol stands for the ASCII escape character (ESC or /027). When the PJL code is entered, print the data file (or use the DOS `COPY` command to copy it to the printer).

Table 3-3 Example: PJL Service Mode Commands

PJL Command	Explanation
$^{E}_{C}$%-12345X@PJL	Start PJL job.
@PJL SET SERVICEMODE=HPBOISEID	Enter Service Mode
@PJL SET PAGES=0	Set page count [= xxxxx]
@PJL SET CRPAPER=LETTER	Sets cold reset page size [= Letter/A4]
@PJL SET SKIPDEMO=FALSE	Skips demo/PCL type page [= true/false]
@PJL SET DIAGNOSTICS=OFF	Sets diagnostics [= OFF/ON] (for ISV use)
@PJL SET SERVICEMODE=EXIT	Exits Service Mode
@PJL DEFAULT PAPER=LETTER	Selects user paper size default
@PJL RESET	Performs PJL reset
$^{E}_{C}$%-12345X	Exits PJL mode
$^{E}_{C}$Z	Prints Self-Test page
$^{E}_{C}$E	Resets the printer.

4

Maintenance

Service Checkpoints

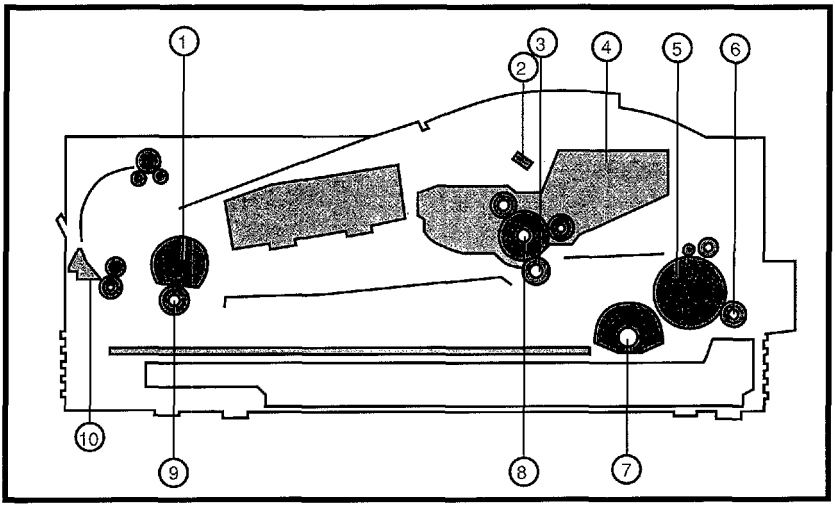


Figure 4-1 Service Checkpoints

1. Upper Fusing Assembly.
2. Beam-to-Drum Mirror.
3. Transfer Roller Assembly.
4. Toner Cartridge.
5. Registration Roller.
6. Front Oblique Roller.
7. Pickup Feed D-Roller.
8. Photosensitive Drum.
9. Fusing Pressure Roller.
10. Face-Up/Face-Down Deflector.

Life Expectancy of Consumables

Always inspect the components listed in Table 4-1 for wear when servicing the printer. Replace these components as needed, based on printer failures or wear, not strictly on usage.

Table 4-1 Life Expectancy of Consumables

DESCRIPTION	PART NO.	EST LIFE (pgs)	REMARKS
Toner Cartridge (user replaceable)	92274A	3000*	When print becomes faint, shake cartridge to distribute remaining toner.
Transfer Roller	RF5-0596-000CN	100,000	May affect print quality and /or paper movement.
Pickup Feed D-Roller	RB1-3368-00CN	100,000	Look for glazing and/or cracks.
Pickup Assembly	RG5-0796-000CN	100,000	Look for glazing and/or cracks, gear wear, sticky solenoids, etc.
Front Oblique Roller Assembly	RG5-0669-000CN	100,000	Look for glazing and/or cracks.
Fusing Assembly 100-120 V, 50/60 Hz (exchange part no.) 220-240 V, 50 Hz (exchange part no.)	 RG5-0676-000CN C2003-69001 RG5-0677-000CN C2003-69002	100,000	May affect print quality and /or paper movement. Look for marks on lower pressure roller or upper Teflon sleeve.

* The estimated toner cartridge life is based on Letter or A4 size paper with an average of 5% toner coverage and a medium density setting. Toner cartridge life can be extended further by conserving toner using the printer's EconoMode feature.

Toner Cartridge Life

The toner cartridge has been designed to simplify the replacement of the printer's major "consumable" parts. The toner cartridge contains the printing mechanism and a supply of toner.

A toner cartridge will print approximately 3000 pages when using a typical word processing application, in which text covers about 5% of the page (see Figure 4-2).

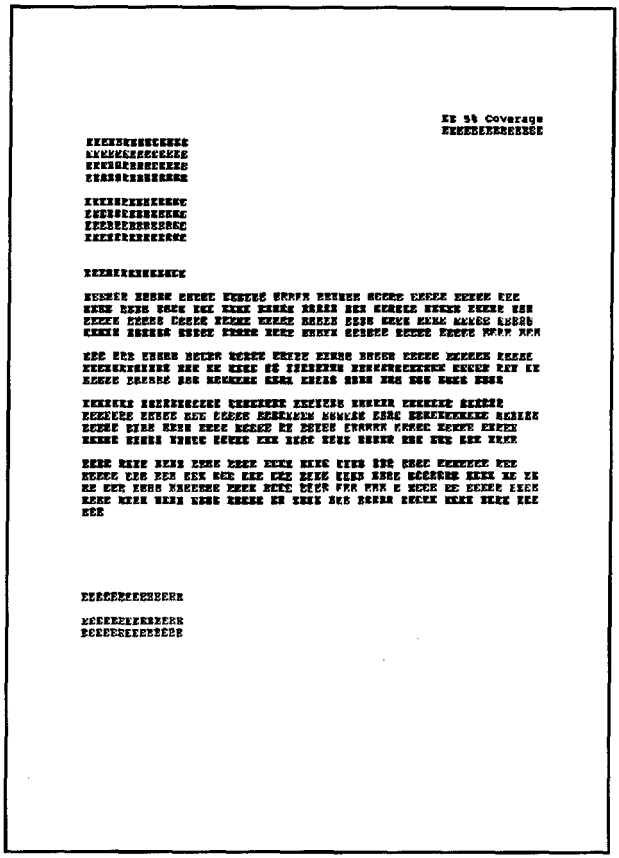


Figure 4-2 Sample 5% Page Coverage

When regularly printing pages with less coverage, such as short memos, a toner cartridge should print over 3000 pages. However, if routinely printing very dense print, the cartridge will not print a full 3000 pages.

Note For best results, always use a toner cartridge before the expiration date stamped on the toner cartridge box.

Saving Toner with EconoMode

Toner cartridge life can be extended dramatically by using the EconoMode printing feature of the printer. EconoMode can be turned on or off via the printer's front panel (LaserJet 4P/4MP only), through HP Explorer's Remote Control Panel or through a software application with the appropriate printer driver. See Chapter 3 for information on the HP Explorer Remote Control Panel.

Notes EconoMode functions in portrait orientation only.

Some software applications may refer to this as "draft mode."

Software settings always override front control panel selections (LaserJet 4P/4MP).

Cleaning Printer Components

CAUTION Do not use ammonia-based cleaners in or around the printer. They will cause damage to the toner cartridge's photosensitive drum.

Table 4-2 Cleaning Printer Components

COMPONENT	CLEANING METHOD/NOTES
Outside Covers	Use a water-dampened cloth. Do not use solvents or ammonia-based cleaners.
Inside General	Use a dry, lint free cloth. Remove all dust, spilled toner, and paper particles.
Front Oblique Roller	Use a cloth or swab dampened with ethyl or isopropyl alcohol.
Pickup Feed D-Roller	Use a water-dampened lint-free cloth.
Registration Roller	Use a dry lint-free cloth.
Transfer Roller	Use a dry, lint-free cloth. DO NOT TOUCH with your fingers.
Beam-to-Drum Mirror	Use filtered, compressed air first. If not effective, use a lint-free cloth or swab dampened with lens cleaner.
Fusing Pressure Roller	Use a cloth or swab dampened with water.
Face-up Deflector	Use a cloth or swab dampened with water.
Anti-Static Teeth	Use compressed air. Refer to Chapter 6 for removal procedure. WARNING!:The Anti-Static Teeth are extremely sharp. Be careful!

Cleaning Spilled Toner

Defective toner cartridges can develop leaks. In addition, after a paper jam has occurred, there may be some toner remaining on the rollers and guides inside the printer. The pages that print immediately after the jam may pick up this toner.

Clean spilled toner with a cloth dampened in cold water. Do not touch the Transfer Roller with the damp cloth or your fingers. Do not use a vacuum cleaner unless it is equipped with a micro-fine particle filter.

Note If toner gets on your clothing, use cold water to remove it. Hot water sets toner stains into fabric.

Clearing Paper Jams

Note Paper jam messages (or status lights) will not clear until the printer's Top Door is opened, then closed, or the front panel button (4L/4ML) or **Continue** key (4P/4MP) is pressed.

Paper jams can be caused by a variety of factors:

- Leaving the rear door open.
- Filling the paper cassette too full.
- Using paper that does not meet specifications (see "Media Specifications" in Chapter 2).
- Removing a paper cassette while a job is printing.
- Failing to place the corners of the paper stock under the front and rear retainer clips in the paper cassette.
- Printing a letter size job on legal paper.

Note Remember to check for loose paper particles and clean any spilled toner after a paper jam has been cleared.

There are three areas of the printer where paper jams can occur:

- **The Paper Feed Area**
- **Inside the printer**
- **Paper Output Area**

Paper Jams in the Paper Feed Area

1. Open the top door by pressing the door release button on the upper right side of the printer.

2. Take out the toner cartridge. (Do not expose the toner cartridge to light for more than a few minutes. Cover it while working on the printer.)

3. Pull out the paper cassette.

4. If paper is in the paper feed area, pull the paper to the right to release it from the oblique feed roller. Then pull the paper straight out.

CAUTION Be careful not to get paper particles caught in the front oblique roller. This can cause repeated jams.

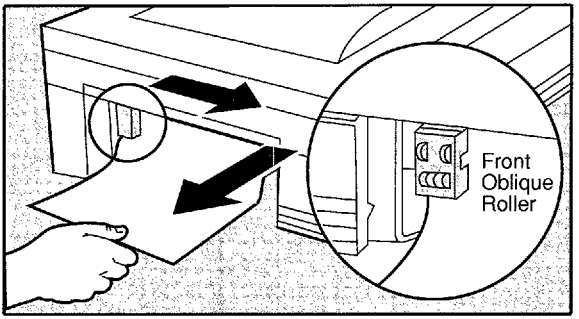


Figure 4-3 Paper Feed Area Jam

5. If Step 4 clears the jam, replace the paper cassette and the toner cartridge, then close the top and rear doors. The printer should return to the Ready state. If it does not, there may still be jammed paper in the printer. Check the top and rear areas of the printer (see the next page).

Paper Jams Inside The Printer

1. Remove the toner cartridge and paper cassette. While holding the printer steady, carefully pull the jammed paper straight out the front to remove it.

CAUTION Do not pull the paper straight up when removing it. The toner on the paper may contaminate the printer and beam-to-drum mirror.

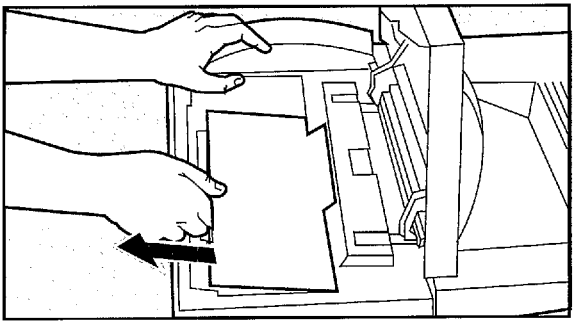


Figure 4-4 Clearing Jams from the Toner Cartridge Area

2. If the trailing edge of the paper is under the transparent cover, pull the paper out and around to remove it.

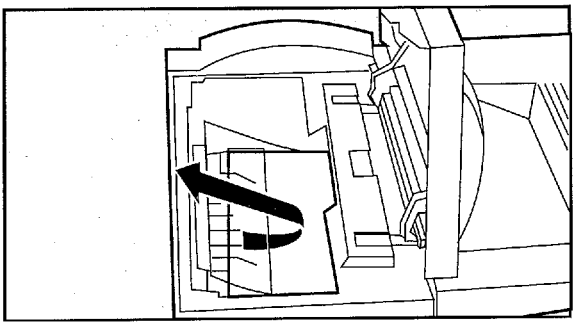


Figure 4-5 Clearing Jams from the Paper Guide

3. If the paper is difficult to remove, you need to relieve some of the pressure in the Fusing Assembly. Open the printer's rear access door. While holding the green paper release lever up, pull the paper out.

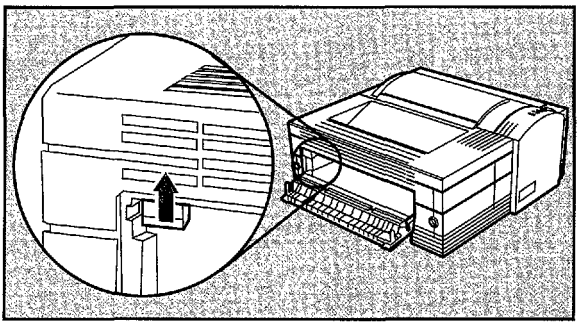


Figure 4-6 Releasing Paper from the Fusing Assembly

4. Replace the paper cassette and the toner cartridge, then close the top and rear doors. The printer should return to the Ready state. If it does not, try one of the following remedies:

   - Ensure the rear access door is fully closed and latched.
   - Check to see if there is more jammed paper in the printer (see the next page).
   - Open and close the printer's top door or press the front panel button briefly.

Paper Jams in the Paper Output Area

1. Open the printer's Top Door and remove the toner cartridge.

2. Open the rear access door.

CAUTION Do not touch the fusing assembly. It may be hot.

3. While pushing the green paper release lever up, pull the paper out. (This lever releases pressure on the fuser roller.)

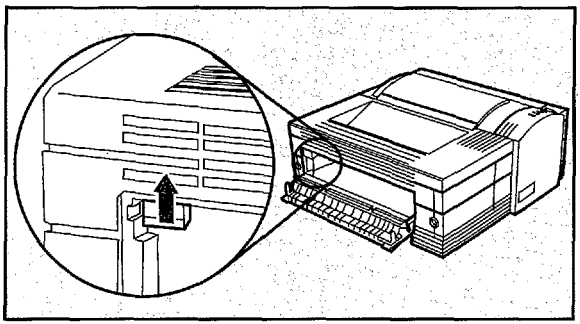
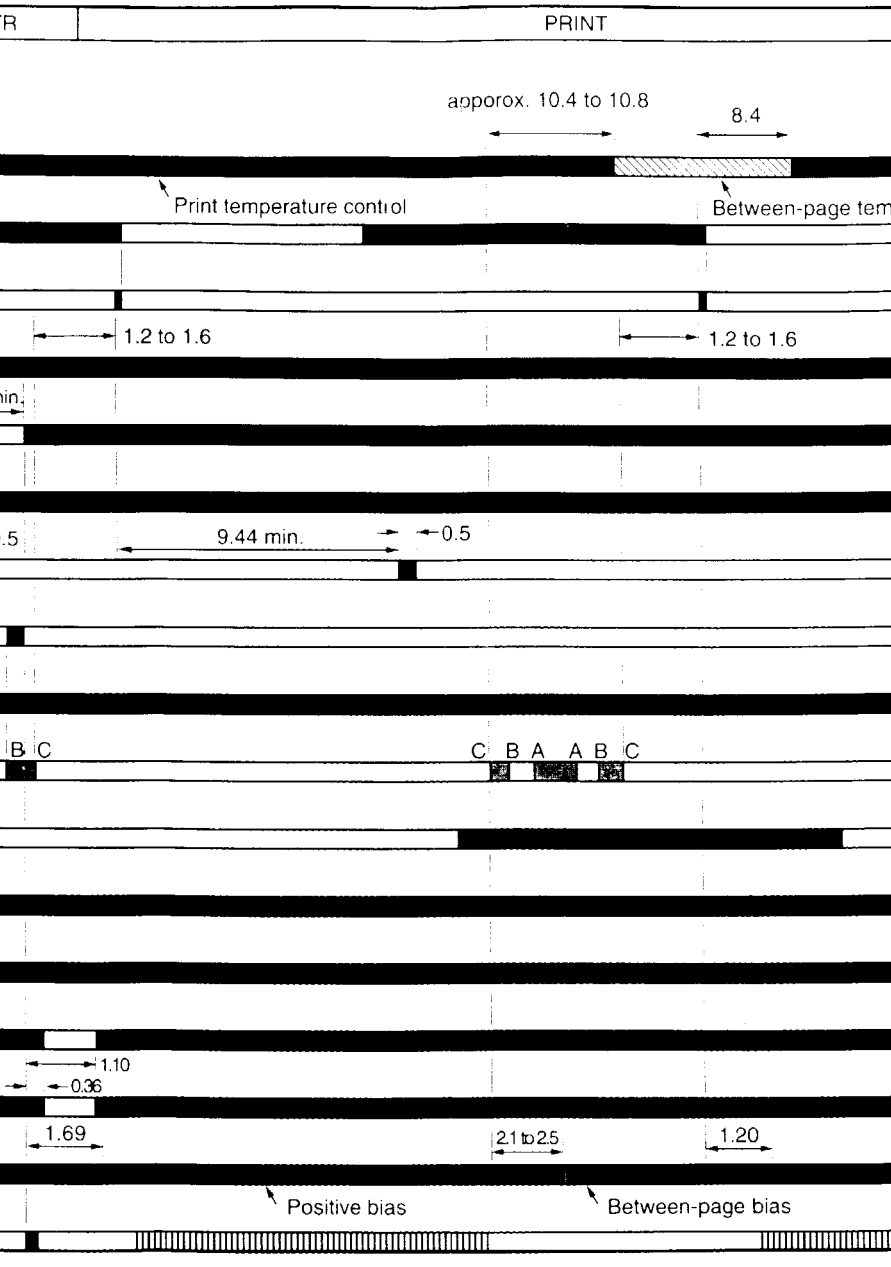


Figure 4-7 Clearing Jams from the Fuser Area

4. Be sure to close the rear access door again. Leaving the rear access door open will cause a paper jam.

Note If there is still a paper jam error condition, check the paper feed and top door areas for paper or particles. If the error persists, refer to Chapter 7, "Troubleshooting."


TR
PRINT
apporox. 10.4 to 10.8
8.4
Print temperature control
Between-page tem
1.2 to 1.6
1.2 to 1.6
9.44 min.
0.5
B C
C B A A B C
1.10
0.36
1.69
2.1 to 2.5
1.20
Positive bias
Between-page bias

5

Functional Overview

Basic Printer Functions

This section of the manual presents a generalized functional overview of the printer. It is designed to provide an understanding of the processes that occur during printing. The following basic printer functions are discussed:

- **DC Controller System**
- **Formatter System**
- **Image Formation System**
- **Paper Feed System**
- **Power System**
- **Basic Sequence of Operation**

Figure 5-1 is a generalized block diagram of the printer:

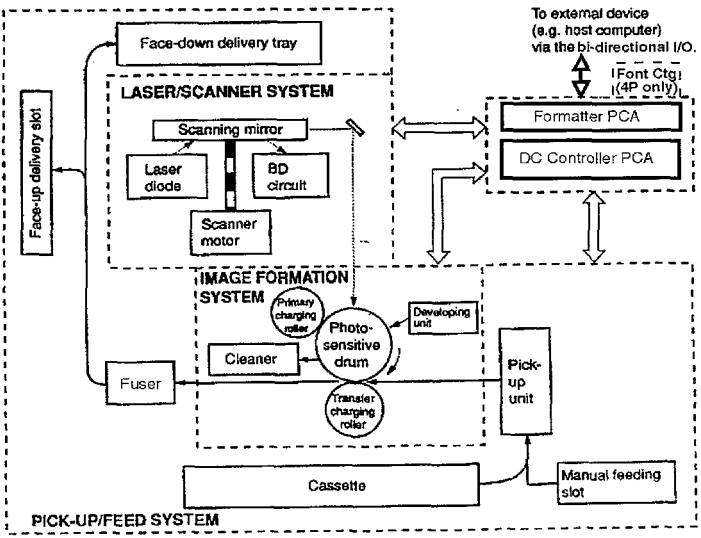


Figure 5-1 Printer Functional Block Diagram

DC Controller/Power System

The DC Controller PCA is responsible for coordinating all print engine activities. The DC Controller drives the laser, coordinating print data from the Formatter PCA with the image formation process. The DC Controller shares machine status information with the Formatter PCA so that proper diagnostic messages are displayed. The DC Controller also provides both ac and dc power supply and distribution circuitry. Figure 5-2 shows the various DC Controller loads.

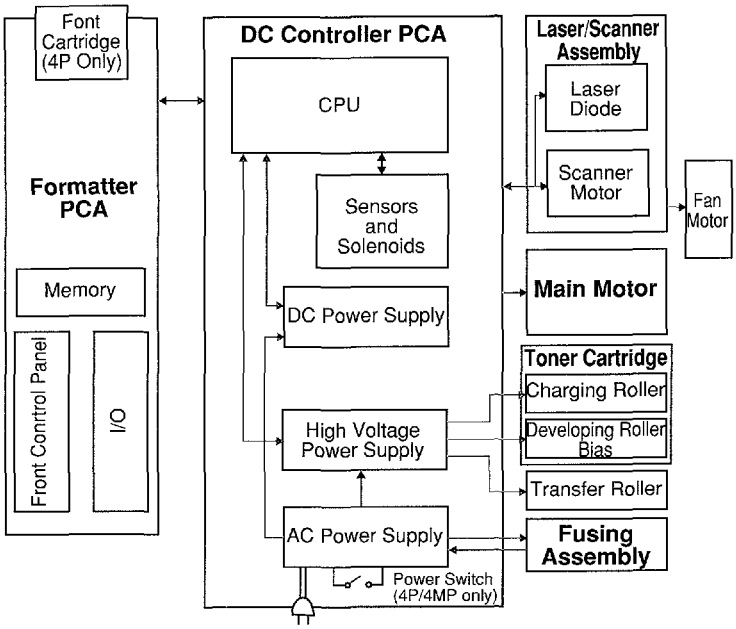


Figure 5-2 DC Controller Loads

In summary, the following systems and functions are controlled by the DC Controller:

- **Print Engine Control**
  - Laser and Scanner Drive
  - Paper Motion
  - Microswitches (Top Door and Engine Test)
  - Motors (Main Drive, Scanner, Fan)
- **Power System**
  - AC Power Distribution
  - DC Power Distribution
  - High Voltage Power Distribution
  - Overcurrent/Overvoltage Protection
  - Intelligent On/Off (LaserJet 4L/4ML only)

Print Engine Control

Laser and Scanner Drive

Based on information received from the Formatter, the DC Controller sends a signal to the Laser/Scanner PCA to modulate the laser diode ON and OFF. The modulated laser beam strikes the surface of a rotating scanning mirror, is directed through a focusing lens onto the Beam-to-Drum Mirror, and is then reflected onto the photosensitive drum.

Synchronization of the process is achieved by continuous monitoring of the beam detect signal, which is fed back to the system from one end of the focusing lens. Refer to "Image Formation System," later in this chapter for more information.

Paper Motion Monitoring and Control

The DC Controller PCA controls paper motion by continuously monitoring the various paper sensors, and coordinating the timing with the other print processes.

For a detailed explanation of paper movement, and the interaction of photosensors and solenoids with the paper movement process, refer to the section "Paper Feed System," later in this chapter.

Top Door/Toner Cartridge Microswitch (SW201)

Microswitch SW201, located on the DC Controller, is activated by both the top door and the toner cartridge. If either the top door is open or the toner cartridge is not installed, the switch opens and an error is issued by the Formatter. On the LaserJet 4L/4ML, the front panel's Error (topmost) LED turns on steady. On the LaserJet 4P/4MP, the display panel message `12 OPEN OR NO EP` is displayed. A toner cartridge must be present and the top door must be closed before the printer can resume printing.

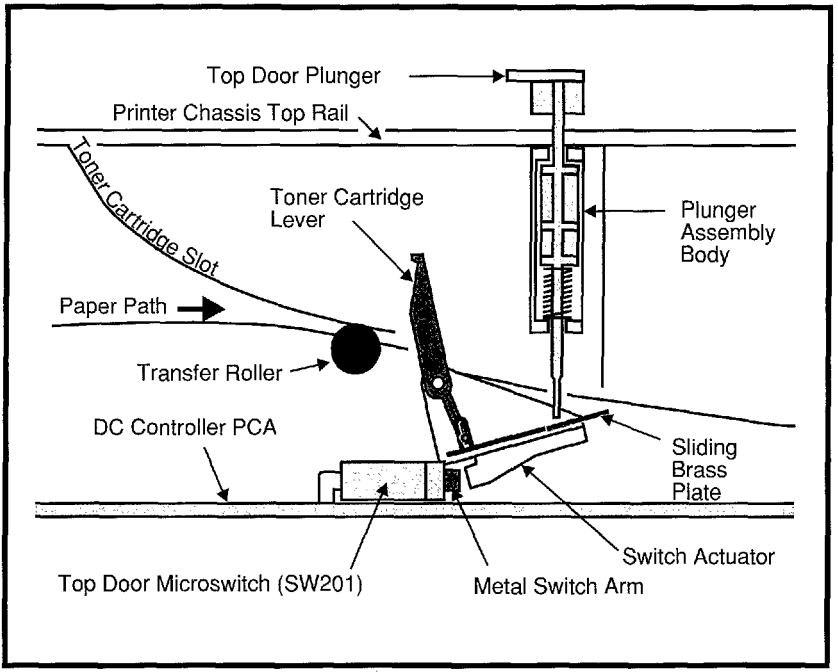


Figure 5-3 Top Cover/Toner Cartridge Plunger & Microswitch (cutaway view)

Engine Test Microswitch (SW301)

Microswitch SW301, also located on the DC Controller, is activated manually through an access hole in the Drive Train Assembly on the left side of the printer. This switch causes the print engine to perform a self test diagnostic, bypassing the Formatter PCA. This test is useful for troubleshooting printer problems because it isolates the print engine from the Formatter. The engine test prints a single page of vertical black lines, which can also be used for adjusting print registration. See "Engine Test' in Chapter 7 for more information.

Note The Engine Test print button can be accessed on the LaserJet 4L/4ML by opening the I/O Door. On the LaserJet 4P/4MP, the printer covers and Formatter PCA must be removed first.

Motors

The **Main Motor (M1)** is controlled by the DC Controller PCA. The Main Motor rotates during the Initial Rotation period (following initial power-ON), the Print period, or the Last Rotation Period, or whenever the printer's top door is opened and closed.

The **Scanner Motor (M2)** is controlled and monitored by the DC Controller and Laser/Scanner PCAs. The Scanner Motor operates during the Initial Rotation period and the Print period.

The **Exhaust Fan Motor (M3)** is controlled and monitored by the DC Controller PCA. The Exhaust Fan Motor operates for approximately 35 seconds during power-ON and Standby. It remains on during Initial Rotation, Print, and Last Rotation Periods.

Power System (on DC Controller PCA)

The ac, dc and high voltage power supply circuits are all contained within the DC Controller PCA.

AC Power Distribution

The ac power circuitry, located on the DC Controller PCA, supplies ac voltage to the DC Power Supply whenever the printer's power cord is connected to the ac power source. (The power switch must be turned ON in the LaserJet 4P/4MP.) A toner cartridge must be installed and the top door closed before voltage is supplied to the High Voltage Power Supply or Main Motor drive circuitry.

DC Power Distribution

The DC Power Supply circuitry, located on the DC Controller PCA, generates +5 V dc, and +12 V dc, which is used as follows:

+5 V dc:	Formatter PCA Photosensors DC Controller Circuitry Laser/Scanner Assembly
+12a V dc: (a=after switch)	High Voltage Power Supply Main Motor
+12b V dc: (b=before switch)	Solenoids Laser/Scanner Assembly (to Fan)

The Power System Block Diagram is illustrated in Figure 5-4.

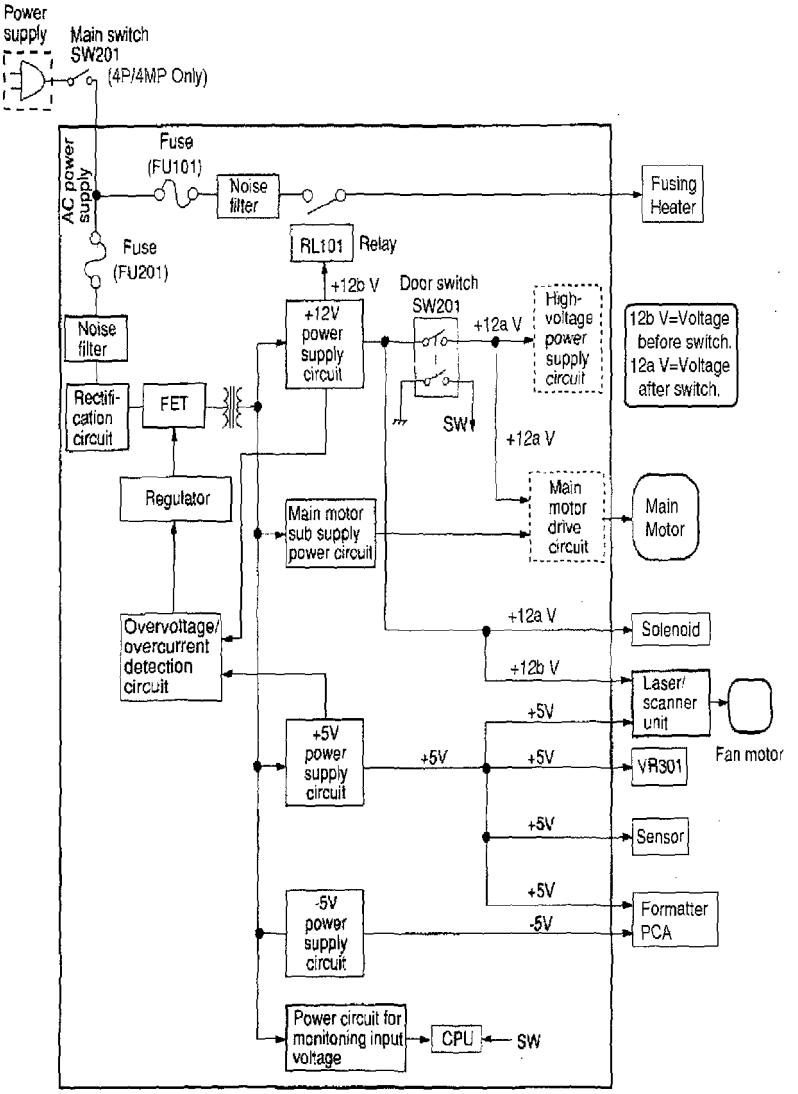


Figure 5-4 Power Supply Block Diagram

Overcurrent/Overvoltage Protection

The +12V dc and +5V dc power circuits each contain an overcurrent/overvoltage protection circuit which automatically shuts off the output voltage when an overcurrent condition occurs due to a short or abnormal voltage on the load side. The protection circuit automatically resets after the input power is cycled OFF then ON.

Fuse FU101 provides overcurrent protection for the Fusing System circuitry. Fuse FU201 (not present on 220-240 V units) provides protection in case of a catastrophic overcurrent condition in the DC Controller power supply regulation circuitry.

Intelligent ON/OFF (LaserJet 4L/4ML only)

This printer feature conserves power by shutting down all the printer's front panel LED status lights after a 15 minute period of inactivity. The printer retains all printer settings and downloaded fonts and macros while in Intelligent Off mode. The lights power ON instantly when any of the following occur:

- A file is printed.
- The front panel button is pressed.
- The printer's top door is opened.
- Paper is inserted into the manual feed slot.
- A paper cassette is removed or installed.

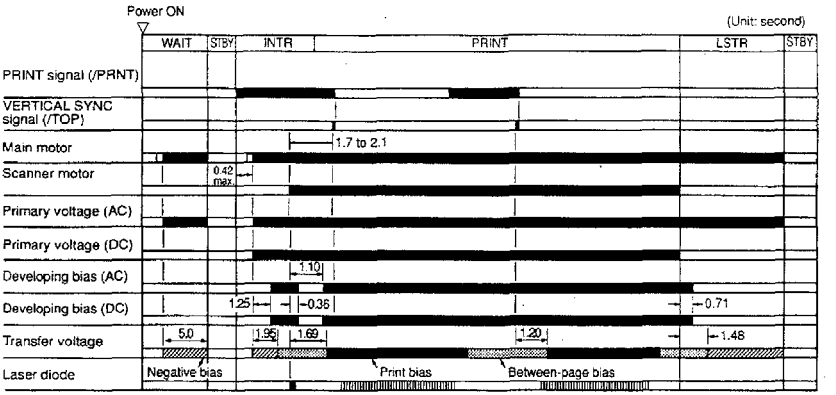
Note The printer will not enter Intelligent Off mode if there is a printer error.

High Voltage Power Distribution

The High Voltage Power Supply circuitry, located on the DC Controller PCA, applies an overlap of dc and ac voltage to the primary charging roller and the developing cylinder. This circuit also applies a positive or negative dc voltage to the transfer charging roller according to the instructions from the CPU on the DC Controller PCA.

This circuit also controls the image density by changing the primary ac voltage and the developing ac bias according to the image density signal from the Formatter.

Figure 5-5 shows the timing of the high voltage power supply.



Note: The transfer voltage changes according to the print sequence as follows:

: Between-page bias (lower positive voltage than the print bias is applied to the transfer charging roller to prevent the damage of the photosensitive drum)

: Negative bias (negative voltage is applied to the transfer charging roller for cleaning)

: Print bias (positive voltage is applied to the transfer charging roller to transfer the toner on the photosensitive drum surface to the paper)

Figure 5-5 High Voltage Power Timing

Formatter System

The Formatter PCA is responsible for the following:

- Receiving and processing ASCII data from the various printer interfaces.
- Monitoring front panel input and relaying printer status information (through the front panel and the bi-directional I/O).
- Developing and coordinating data placement and timing with the print engine.
- Storing font information.
- Communicating with the host computer.

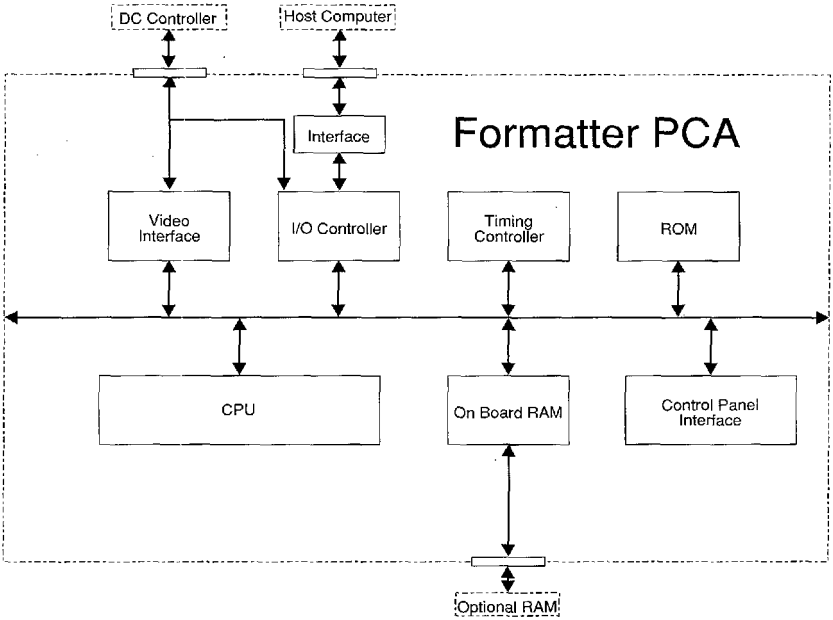


Figure 5-6 Formatter Block Diagram

The Formatter PCA receives ASCII data from the Bi-Tronics Interface and converts it into a dot image. The image orientation (portrait or landscape) and the font type are both selected. When the scan buffer is full, or when a Form Feed command is received, the Formatter sends a PRINT signal to the DC Controller. The DC Controller synchronizes the Image Formation System with the Paper Feed System, and signals the Formatter to send the print image data. The Formatter sends the print image data (dots) in the form of a VIDEO signal and the printing process begins.

CPU

The Formatter PCA incorporates the following microprocessors:

- LaserJet 4L - Motorola 68000, 16 MHz.
- LaserJet 4ML - Intel 80960KA, 18.5 MHz.
- LaserJet 4P - Intel 80960SA, 16 MHz.
- LaserJet 4MP - Intel 80960KA, 18.5 MHz, 32K instruction cache.

Read Only Memory (ROM)

Besides storing microprocessor control programs, the ROM stores the dot patterns of internal character sets (fonts).

Random Access Memory (RAM)

The RAM stores printing and font information received from the host system, and can also serve to temporarily store a full page of print image data before the data is sent to the print engine (see "Page Protect"). RAM memory capacities for each printer are shown under "Printer Features" in Chapter 1. Note that adding memory will not increase I/O buffer space or print speed.

Note The LaserJet 4P/4MP printers support 32-bit SIMMs (C303XA series) as well as the 36-bit SIMMS (C206XA series) used in earlier LaserJet family printers.

Non-Volatile Memory (NVRAM)

LaserJet 4L: The HP LaserJet 4L printer does not use NVRAM. As long as the printer is connected to an ac power source, configuration and page count information (as well as any downloaded fonts and macros) is retained in conventional RAM. When power is disconnected, RAM contents are lost, page count returns to zero, and the printer returns to factory default settings.

LaserJet 4ML/4P/4MP: 256 bytes of NVRAM is used on these printers to store I/O and print environment configuration information. The contents of NVRAM are retained when the printer's power is turned off or disconnected. (As in other HP LaserJet printers, downloaded fonts and macros are saved in conventional RAM, and are lost when power is turned off.)

Parallel Interface

The Formatter PCA receives incoming ASCII data through its Bi-Tronics interface connector. The Bi-Tronics I/O provides high speed two-way communication between the printer and the host, allowing the user to change printer settings and monitor printer status from the host computer. The Bi-Tronics I/O is compatible with the Centronics parallel interface standard.

Note Refer to "Parallel Cable Pin Configuration" in Appendix B for parallel pin assignments.

High Speed (Yes/No)

The "High Speed (Yes/No)" configuration item is user-selectable. The default setting, "Yes" allows the I/O to run at the higher speeds supported by most newer PCs. If the mode is set to "No," the parallel interface runs at the slower, but compatible mode for older PCs.

Advanced Functions (On/Off)

The "Advanced Functions (On/Off)" configuration item is also user-selectable. The default setting, "On" allows for "Bi-tronics" two-way parallel communications. The "Off" mode disables the Bi-tronics advanced functionality.

Serial I/O (LaserJet 4P/4MP)

The LaserJet 4P/4MP printer supports RS-232 compatible serial communications. The printer uses a 9-pin D-subminiature connector. (See Appendix B for pin-out information.)

Pacing (Serial Modes of Operation)
The "Pacing" configuration item is user-selectable. Available choices under Pacing are:

- **DTR/DSR** (default) - This mode, primarily implemented for PCs, has bi-directional data flow which is paced using hardware pacing. No XON or XOFF signals are sent.

- **XON/XOFF** - This mode is primarily intended for UNIX machines which cannot perform hardware pacing yet want bi-directional data flow. Data flow is paced using XON and XOFF signals to indicate when the printer is ready to accept new data from the host.

LocalTalk I/O (LaserJet 4ML/4MP)

The LaserJet 4ML/4MP printers implement the AppleTalk networking protocol through the LocalTalk hardware. The LocalTalk network cable (HP P/N 92215N) is connected through an 8-pin DIN connector on the printer's I/O panel. (See Appendix B for more cabling information.)

Control Panel

LaserJet 4L/4ML

Status LED Lights: The Formatter uses four lights to communicate printer status to the user. Light from the LEDs is transmitted through a single piece Light Pipe Assembly, mounted on the inside of the printer cover. Refer to "Using the Control Panel," in Chapter 3, and to "Printer Error Troubleshooting" in Chapter 7, for more information on the lights.

Front Panel Button: The Formatter PCA includes a microswitch which is activated by the front panel button through a switch actuator which mounts on the surface of the PCA. The single button is used for such functions as self test, reset and displaying error codes. Refer to "Using the Control Panel," in Chapter 3 for more information on the front panel button.

LaserJet 4P/4MP

The Formatter PCA on the LaserJet 4P/4MP sends and receives printer status and command data via a Control Panel PCA, which consists of an LCD display window and an 8-key keypad.

LCD Display Window: The Formatter uses a backlit 16-character LCD display window in conjunction with three lights to communicate printer status to the user. Display window messages can be configured in any of several languages.

8-Key Keypad: The eight keys on the keypad are used for a variety of functions, such as switching online/offline, configuring the printer, initiating self tests, form feeds, or resets, and turning EconoMode on and off. A keyboard overlay is available in any of several different languages (see Chapter 8 for part numbers).

Resolution Enhancement (REt)

The printer's Formatter PCA contains circuitry for Resolution Enhancement technology (REt), which modifies the standard video dot data on its way to the DC Controller to produce "smoothed" black-to-white boundaries. REt is user-adjustable from the front control panel (LaserJet 4P/4MP only), from HP Explorer's Remote Control Panel (Print Quality Category), or from some software applications. Available settings are Light, Medium, Dark, or Off. The default setting is Medium.

Note REt settings sent from software or printer drivers override any control panel settings.

Print Density Adjustment

Adjusting print density affects the line width (boldness) of the print image. This is accomplished by varying the developer dc bias, which controls the amount of toner applied to the photosensitive drum. Print Density is adjustable through HP Explorer's Remote Control Panel (Print Quality Category). The range of settings is from 1 (lightest) to 5 (darkest). The default setting is 3.

EconoMode

The EconoMode setting uses approximately 50% less toner than standard mode printing by reducing the dot density. EconoMode, which can also be thought of as "draft mode," is user selectable via a front panel key (LaserJet 4P/4MP only), or via a PJL sequence using HP Explorer's Remote Control Panel, or through application software. The default setting is Off.

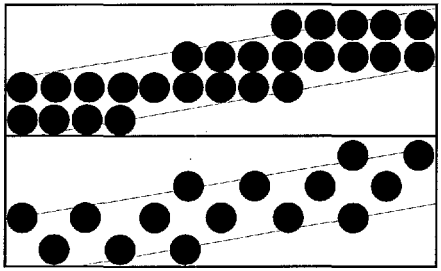


Figure 5-7 EconoMode vs. Regular Print

Note EconoMode does not affect print speed or memory usage.

Memory Management

The printers use various methods to conserve and make the most of available memory. Several of these are explained below.

Note LaserJet 4P/4MP: If the printer encounters difficulty in managing available memory, a "Clearable Warning" message will be displayed on the front control panel. See "Clearable Warnings" in Chapter 7 for details.

Memory Enhancement technology (MEt)

HP's Memory Enhancement technology (MEt) effectively doubles the printer's standard memory through a variety of font and data compression methods. MEt also automatically compresses fonts for desktop publishing applications.

When printing graphics, MEt analyzes each page as it is being printed and automatically applies a variety of methods to print the complete page at the correct resolution. Two of these methods, Image Adapt and Page Protect, are user-selectable through HP Explorer's Remote Control Panel (Printer Memory Category).

Note MEt is only available in PCL mode; it is not functional when printing in PostScript mode.

Image Adapt (LaserJet 4L/4ML)

Image Adapt uses a compression technique to allow printing of full-page graphics using the printer's base memory. The available settings are Auto, On, and Off. The default setting is Auto.

Some data may be lost if Image Adapt is used. To see if there has been some loss of graphic detail, print a self test page and check the "Image Adapt Used:" line in the Printer Information section of the page. If the printer invoked Image Adapt since the last time the self test was printed (or the last power cycle), that line will read "Image Adapt Used: Yes."

Note LaserJet 4L/4ML: The Image Adapt information on the self test page resets every time the self test page prints, or the printer is disconnected from its power source.

Page Protect

A page's complexity (rules, complex graphics or dense text) may exceed the printer's ability to create the page image fast enough to keep pace with the engine's printing process. If a page is too complex, it may print in parts (for example, the top half of data on one page and the bottom half on the next page). Some print data loss is likely in these instances, and the printer's Error light flashes.

Page Protect allows the Formatter to create the entire page image in memory before physically moving the paper through the printer. This process ensures that the entire page will be printed. Page Protect is user selectable through HP Explorer's Remote Control Panel (Printer Memory Category). The default setting is Auto.

PJL Overview

Printer Job Language (PJL) is an integral part of configuration, in addition to the standard Printer Command Language (PCL). (See "PJL Software Commands" in Chapter 3 for more information.)

With standard Centronics cabling, PJL allows the printer to perform functions such as:

- **Two-way communication** with the host computer through a Bi-directional Parallel connection. The printer can tell the host such things as the control panel settings, and allow the control panel settings to be set from the host.

- **Dynamic I/O switching** (LaserJet 4ML/4P/4MP) allows the printer to be configured with a host on each I/O. The printer can receive data from more than one I/O simultaneously, until the buffer is full. This can occur even when the printer is offline.

Note The Serial and LocalTalk I/Os share the same softare interrupt. Thus, dynamic I/O switching is limited to switching between the parallel interface and one other I/O interface selected from serial and LocalTalk.

- **Context-sensitive switching** (LaserJet 4ML/4P/4MP only) allows the printer to recognize automatically the personalities (PostScript or PCL) of each host and configure itself to serve that personality.

- **Isolation of print environment settings** from one print job to the next. For example, if a print job is sent to the printer in landscape mode, the subsequent print jobs print in landscape only if they are formatted for landscape printing.

Image Formation System

Laser printing requires the interaction of several different technologies (such as electronics, optics, and electrophotographics) to provide a printed page. Each process functions independently and must be coordinated with all other printer processes. The image formation process consists of six stages:

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

The toner cartridge houses the cleaning, conditioning, and developing stages of the process. Components of the image formation system that wear, degrade, or are consumed are built into the replaceable cartridge. The toner cartridge contains the photosensitive drum, primary charging roller, developing station, toner cavity, and cleaning station. This eliminates the need for a service call when replacement is required.

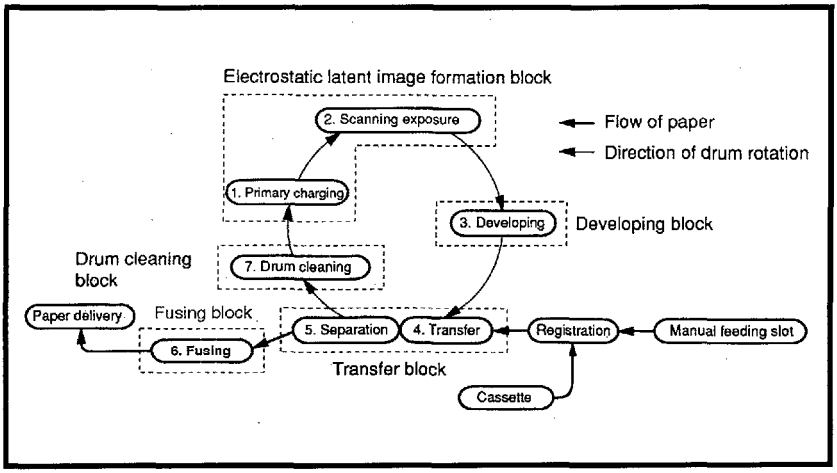


Figure 5-8 Image Formation Block Diagram

Photosensitive Drum

The photosensitive drum is the "heart" of the Image Formation System. The special properties of this drum allow an image to be formed on the drum's surface and then transferred to paper. The drum is an extruded aluminum cylinder. The outside of the cylinder is coated with a layer of organic-photoconductive material (OPC) which is non-toxic. The aluminum base of the photosensitive drum is electrically connected to ground potential (see Figure 5-9).

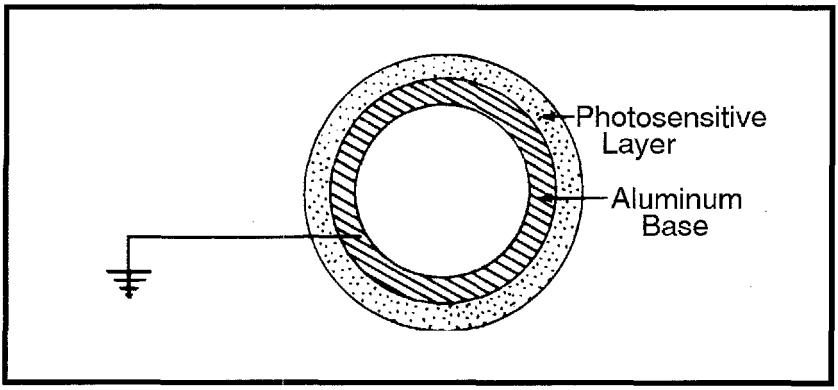


Figure 5-9 Photosensitive Drum

Drum Sensitivity

The OPC material has properties similar to a photo-resistor. It becomes electrically conductive when exposed to light. When the photosensitive drum is exposed to light, the negative charges deposited on it are conducted to the ground potential of the drum's base. Areas not exposed to light remain nonconductive and maintain their negative charge.

CAUTION The printer's toner cartridge does not include a light blocking shutter. Be careful to avoid exposing the drum to light, which can permanently damage the drum. Protect the cartridge whenever removing it from the printer, preferably by inserting it into the protective bag from its packaging.

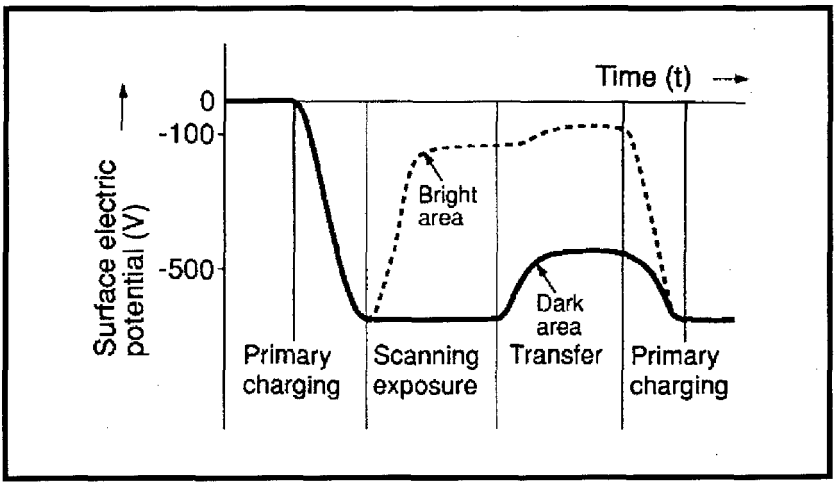


Figure 5-10 Drum Surface Potential

Cleaning Stage

During the cleaning stage of the image formation process, the drum's surface is physically cleaned, preparing it to hold an image. During printing, the drum is rotating constantly making several complete rotations per printed page. Before forming the image for a given section of print, a cleaning blade removes toner from the previous rotation of the drum. The excess toner is stored in the toner cartridge where it is prevented from being used in later print jobs (see Figure 5-11).

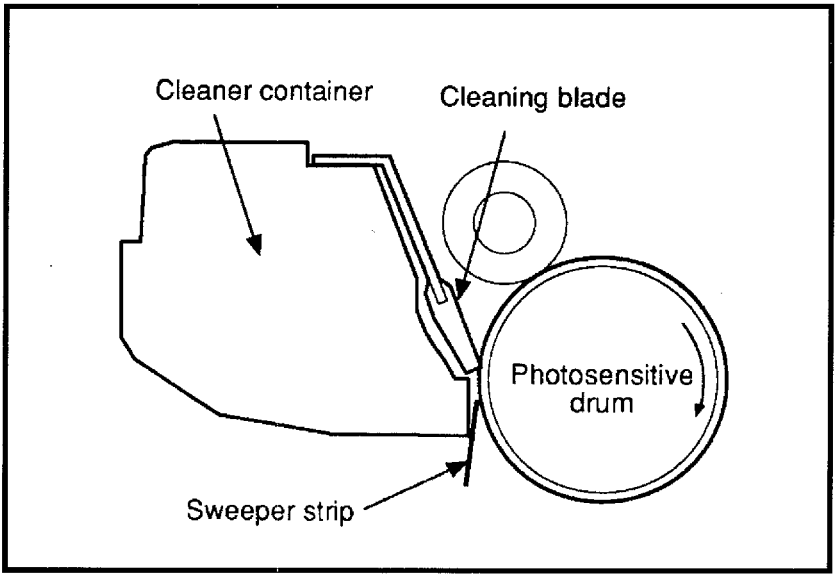


Figure 5-11 Drum Cleaning

Conditioning Stage

After the drum is physically cleaned, it must be conditioned. This process consists of applying a uniform negative charge on the surface of the drum with the primary charging roller, located in the toner cartridge. The primary charging roller is coated with conductive rubber with an ac bias applied to erase any residual charges and maintain a constant drum surface potential. In addition, a negative dc bias is applied by the charging roller to create a uniform negative potential on the drum's surface. The amount of dc voltage is modified by the print density setting.

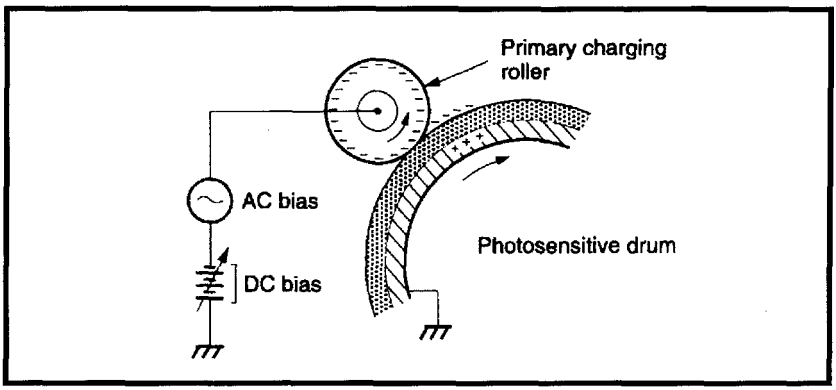


Figure 5-12 Primary Charging Roller

Writing Stage

At the writing station, the laser beam is used to discharge the photosensitive drum's negative potential by focusing laser light onto its surface. This creates a latent electrostatic image, which later is developed into a visible image.

Laser light is produced by a small modulated laser diode. The beam created by the diode shines onto a rotating polygonal mirror. As the mirror rotates, the beam reflects off the mirror and sweeps the page from left to right (see Figure 5-13).

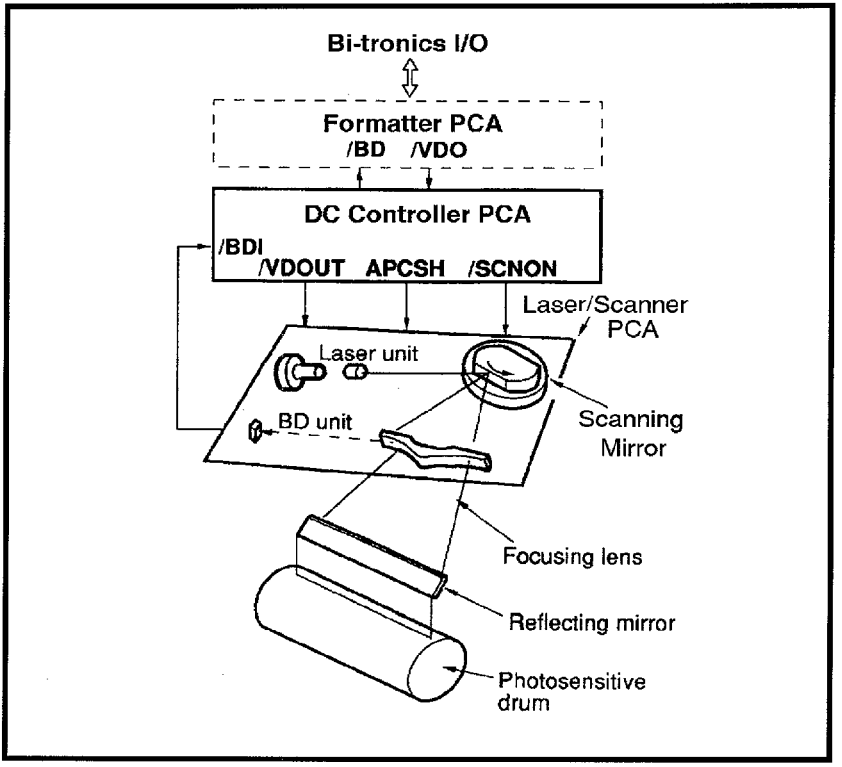


Figure 5-13 Image Writing

A set of lenses and mirrors focuses the horizontal sweeping beam through the laser beam access slot in the rear of the toner cartridge, and onto the photosensitive drum. Because the beam is sweeping the entire length of the drum and the drum is rotating, the entire circumference of the drum can be covered. The speed of the scanner motor (which turns the scanning mirror) and the speed of the main motor (which turns the drum) are synchronized, and each successive sweep of the beam is offset 1/300th (or 1/600th) of an inch. The beam can be turned on and off to place a dot of light every 1/300th (or 1/600th) of an inch in the horizontal direction. This is how the printer achieves its 300 x 300 dpi (or 600 x 600 dpi) resolution.

At the beginning of each sweep (before the beam reaches the drum), the beam is reflected off the beam detect mirror. The momentary pulse of light is sent to the DC Controller, where it is converted to an electrical signal used to synchronize the output of data (VDO) for one sweep (scan line). This pulse, referred to as the Beam Detect signal (BD), is used to diagnose problems with the laser diode or scanner motor.

After the writing station, the drum surface has an invisible (latent) electrostatic image. Portions of the drum not exposed to the laser are still at the uniform negative potential (placed there by the primary charging roller), but those portions exposed to light have been discharged to ground, to form the latent electrostatic image.

Developing Stage

The developing station develops the latent electrostatic image into a visible image on the drum. The developing unit consists of a metallic cylinder that rotates around a fixed magnetic core inside the toner cavity. Toner is a powdery substance made of black plastic resin bound to iron particles, which is attracted to the magnetic core of the cylinder. A rubber blade "brushes" the toner on the developing cylinder to a uniform thickness.

The toner particles obtain a negative surface charge by rubbing against the developing cylinder which is connected to a negative dc supply. The negatively charged toner is attracted to the discharged (grounded) areas of the drum exposed to laser light, and repelled from the negatively charged (non-exposed) areas. An ac potential is applied to the developing cylinder to decrease the attraction between the toner and the magnetic core of the cylinder, and to increase the repelling action of toner against the areas of the drum not exposed to laser light. This ac potential improves density and contrast (see Figure 5-14).

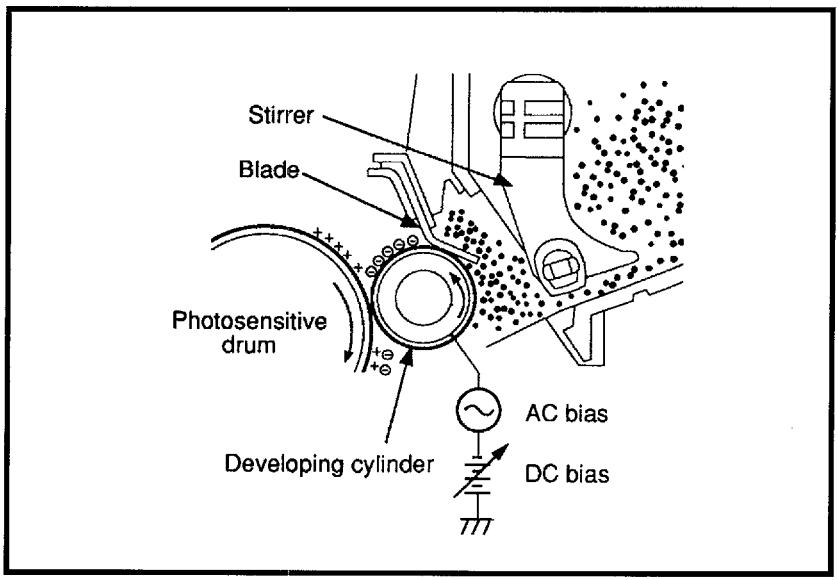


Figure 5-14 Image Development

The dc bias of the developing cylinder is adjusted to change the force of attraction between the toner and drum by changing the print density setting (from the front panel or through software). A change in dc bias causes either more or less toner to be attracted to the drum, which in turn either increases or decreases the print density. The print density variation is approximately ± 10% (see Figure 5-15). Both the primary and developer dc bias voltages are changed in response to the density setting.

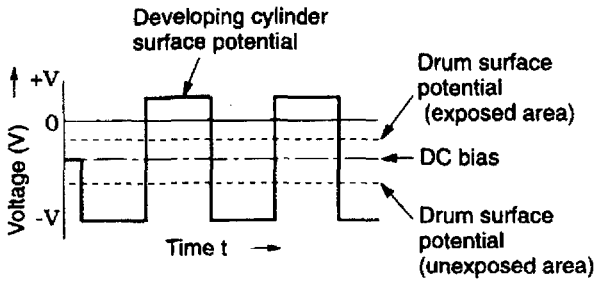


Figure 5-15 Developing Potentials

Transferring Stage

At the transferring station, the toner image on the drum's surface is transferred to the paper. A positive charge applied to the back of the paper by the transfer roller causes the negatively charged toner on the drum's surface to be attracted to the page.

The small radius of the drum, combined with the stiffness of the paper causes the paper to peel away from the drum. The Static Eliminator also helps separate the paper from the drum. The Static Eliminator weakens the attractive forces between the negatively charged drum surface and the positively charged paper. Without this help, thin paper can wrap around the drum. After separation, the paper moves to the fusing station and the drum rotates to the cleaning and conditioning stations.

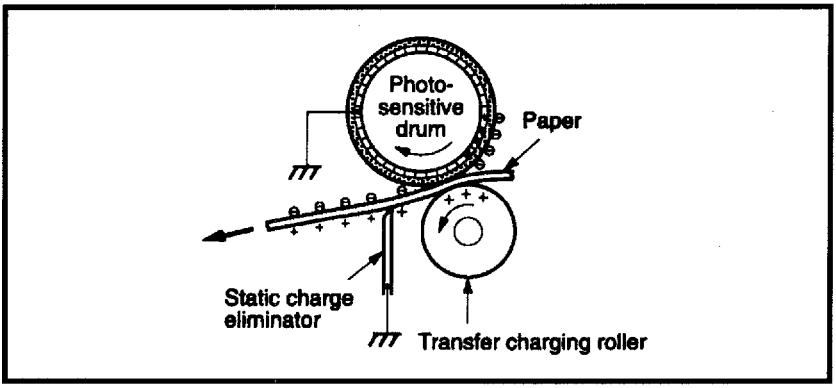


Figure 5-16 Transferring Stage

Fusing Stage

At the fusing station, the toner is fused into the paper by heat and pressure to produce a permanent image. The paper passes between a ceramic heating element protected by a thin, Teflon sleeve and a soft pressure roller. This melts the toner and presses it into the paper.

The ceramic heating element comes up to fusing temperature very quickly, and thus **does not require any power** while the printer is on STANDBY. These are the first Hewlett-Packard LaserJet printers to employ this "instant-on" fusing system. Other laser printers use a halogen heating lamp and require frequent warming to maintain a minimum standby temperature. This feature saves power while virtually eliminating the warm-up period.

The fusing temperature is monitored by the DC Controller PCA, using a thermistor (TH901). The DC Controller maintains a temperature of about 180° C during print mode. If the fusing system overheats (about 215° C), a relay opens the power circuit to the fusing heater, causing a Fuser Error message. If the fusing system exceeds 240° C, the thermal fuse will open, cutting off power to the fuser.

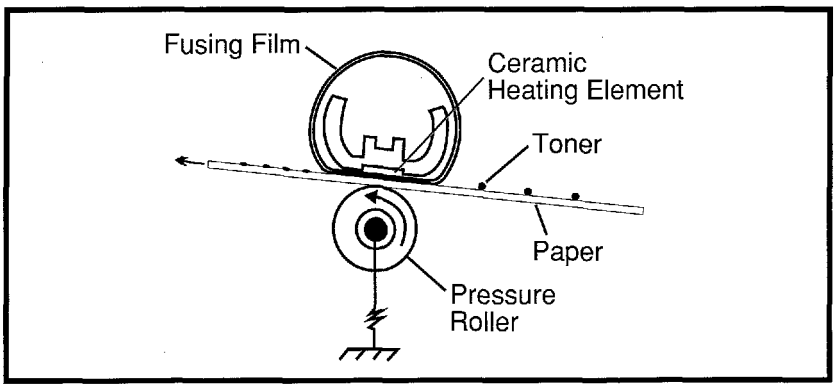


Figure 5-17 Fusing Film and Pressure Roller

Paper Feed System

The following topics are discussed in this section:

- **Paper Movement Overview**
- **Solenoids**
- **Photosensors**
- **Paper Out Sensor**
- **Input Paper Sensor**
- **Printing from the Paper Cassette**
- **Printing from Manual Feed**
- **Paper Jam Detection**

Paper Movement Overview

The paper feed system picks print media automatically from the paper cassette or accepts it from the manual feed slot and delivers it to the image formation system at precisely the right time. The system then feeds the media to the fusing station, and delivers the finished product to the output position, either the face-down output tray on top of the printer, or through the face-up delivery slot at the rear of the printer. The output path is user-selectable by turning the paper path knob on the rear of the printer.

Figure 5-18 shows the possible paper paths and locations of the various solenoids, photosensors and rollers.

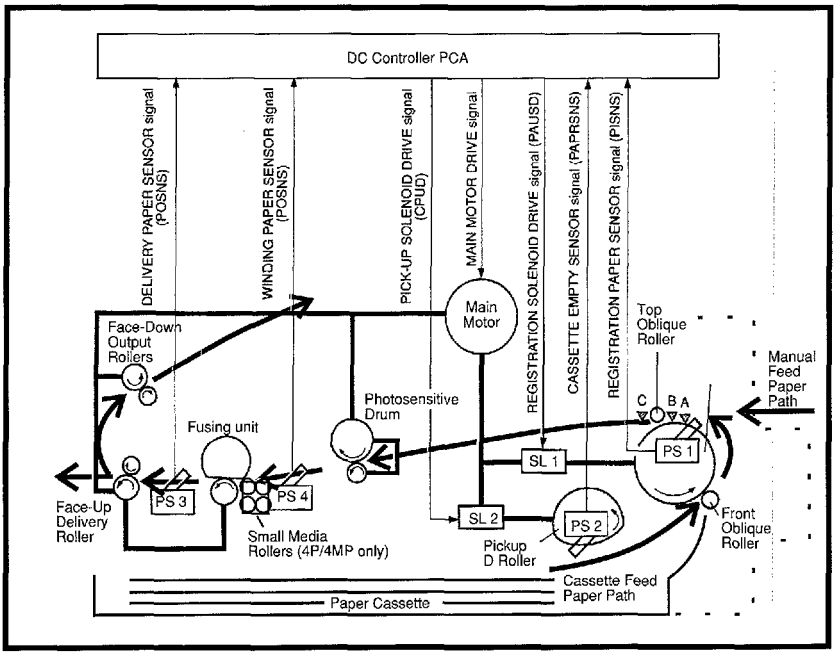


Figure 5-18 Printer Paper Path

PS1	Input Paper Sensor
PS2	Paper Out Sensor
PS3	Exit Paper Sensor
PS4	Winding Paper Sensor

Input Paper Sensor (PS1) Positions:

A = Manual Feed Sense Position

B = Registration Sense Position

C = TOP Sense Position

Solenoids

Table 5-1 Solenoids

No.	Name	Description
SL1	Paper Feed Solenoid (Registration)	Located in the Pickup Roller Assembly, and controls the registration rollers.
SL2	Pickup Solenoid	Located on the DC Controller, and controls the Pickup Feed D-Roller.

Photosensors

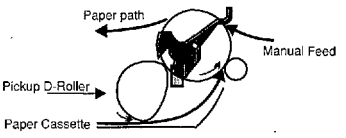
Table 5-2 Photosensors

No.	Name	Description
PS1	Input Paper Sensor	Four-position photosensor. Senses manual feed and paper at registration position.
PS2	Paper Out Sensor	Senses empty paper cassette.
PS3	Exit Paper Sensor	Senses paper exiting the fuser rollers.
PS4	Winding Paper Sensor	Senses paper in the paper feed guide area.

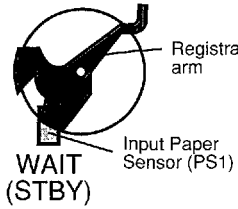
Paper Out Sensor (PS2)

The Paper Out Sensor (PS2) detects the presence of paper in the cassette. If no paper is sensed in the cassette, the Formatter displays the paper-out indication on the front panel (display panel message or Paper light). The cassette must be reloaded before printing can resume.

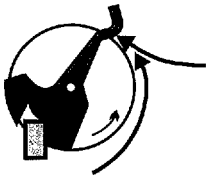
Input Paper Sensor (PS1)



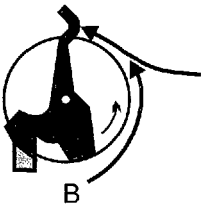
The Input Paper Sensor, PS1, is a four position sensor that detects paper in the Manual Feed Sense Position, the Registration Position, and the Top Position. The figure to the left shows the Manual Feed and Cassette paper paths. The figures below show the sensor in each of the four positions.



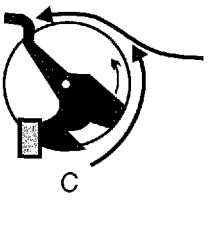
The Ready or Wait/Standby Position indicates that paper has not entered the paper path.



The Manual Feed Sense Position (A) indicates that paper has either been inserted into the manual feed slot or has been picked from the paper cassette and reached this position in the paper path.



The Registration Position (B) signals the DC Controller to monitor if the scanner motor is up to speed and the fuser is at the correct temperature. When both conditions are met, the paper continues to the Top Position. If these conditions have not been met, solenoid SL1 is engaged to stop the registration roller until the printer is ready. When the printer is ready, SL1 disengages and paper proceeds to the Top Position.



The Top Position (C). When paper passes through the Top Position, the DC Controller sends a signal to synchronize the image on the photosensitive drum with the top of the page.

Printing from the Paper Cassette

Paper motion begins when the DC Controller PCA, after receiving a PRINT signal, starts the Scanner Motor, the Main Motor, and the fusing heaters. The Pickup Solenoid (SL2) is energized for 0.5 seconds, the pickup roller and the registration roller rotate and feed a sheet of paper from the Paper Cassette to the Registration Position, where the registration roller is stopped by solenoid SL1, if necessary, until the Scanner and Fuser are ready. While the registration roller is rotating, the oblique rollers are aligning the paper's left edge correctly to prevent skewing (see Figure 5-19).

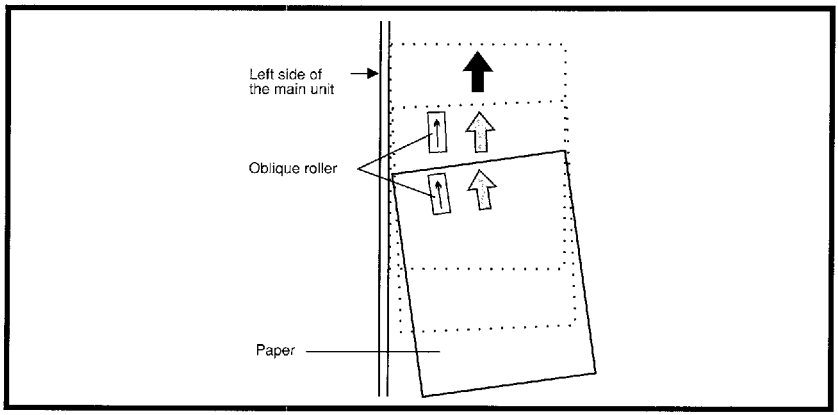


Figure 5-19 Oblique Roller Paper Alignment

The Formatter PCA sends the $\overline{\text{VDO}}$ signal to the print engine within a specified amount of time after the Input Paper Sensor (PS1) reaches the Top Position. The leading edge is now aligned, ready to proceed under the photosensitive drum. After the paper passes under the drum, past the Winding Sensor (PS4), and through the fusing unit, it triggers the Exit Paper Sensor (PS3). The paper is then fed through either the face-up delivery slot or the face-down output rollers and to the top output tray, depending on the position of the face-up deflectors.

Manual Feed Printing

The presence of paper in the manual feed slot is detected when the Input Paper Sensor (PS1) reaches the Manual Feed Sense Position. The Manual feed system's paper motion begins when the DC Controller PCA, after receiving a PRINT signal, starts the Scanner Motor, the Main Motor, and the fuser heating element. The Registration Solenoid (SL1) is OFF at this time, allowing the registration roller to rotate. This feeds the paper from the Manual Feed slot to the Registration Position.

The remainder of the manual feed print process is identical to the cassette feed process, described above.

Small Media Rollers (LaserJet 4P/4MP)

The LaserJet 4P/4MP has an additional set of Small Media Rollers, located midway between the pickup and delivery rollers (see Figure 5-18). These rollers allow the printer to accept a smaller minimum paper size: 3 x 5 inches (76 x 127 mm).

Paper Jam Detection

The Input Paper Sensor (PS1), Paper Exit Sensor (PS3), and the Winding Paper Sensor (PS4) detect when paper is moving through the printer (see Figure 5-18 for sensor locations). If a paper jam is detected, the DC Controller immediately stops the printing process and causes a paper jam indication on the front panel.

A paper jam can be detected under any of the following conditions:

Power-On Jams

Paper is present under either PS1, PS4 or PS3 at power-on.

Pickup Jams

Paper does not reach and clear photosensor PS1 within a specified period of time. For cassette feed the time period begins when the Paper Pickup Solenoid (SL2) is energized; for manual feed the time period begins shortly after PS1 is moved into the Manual Feed Sense Position (position "A" under "Input Paper Sensor").

Delay Jams

Paper does not reach or clear a specific photosensor within a specified period of time.

Basic Sequence of Operation

Standard Printer Operation

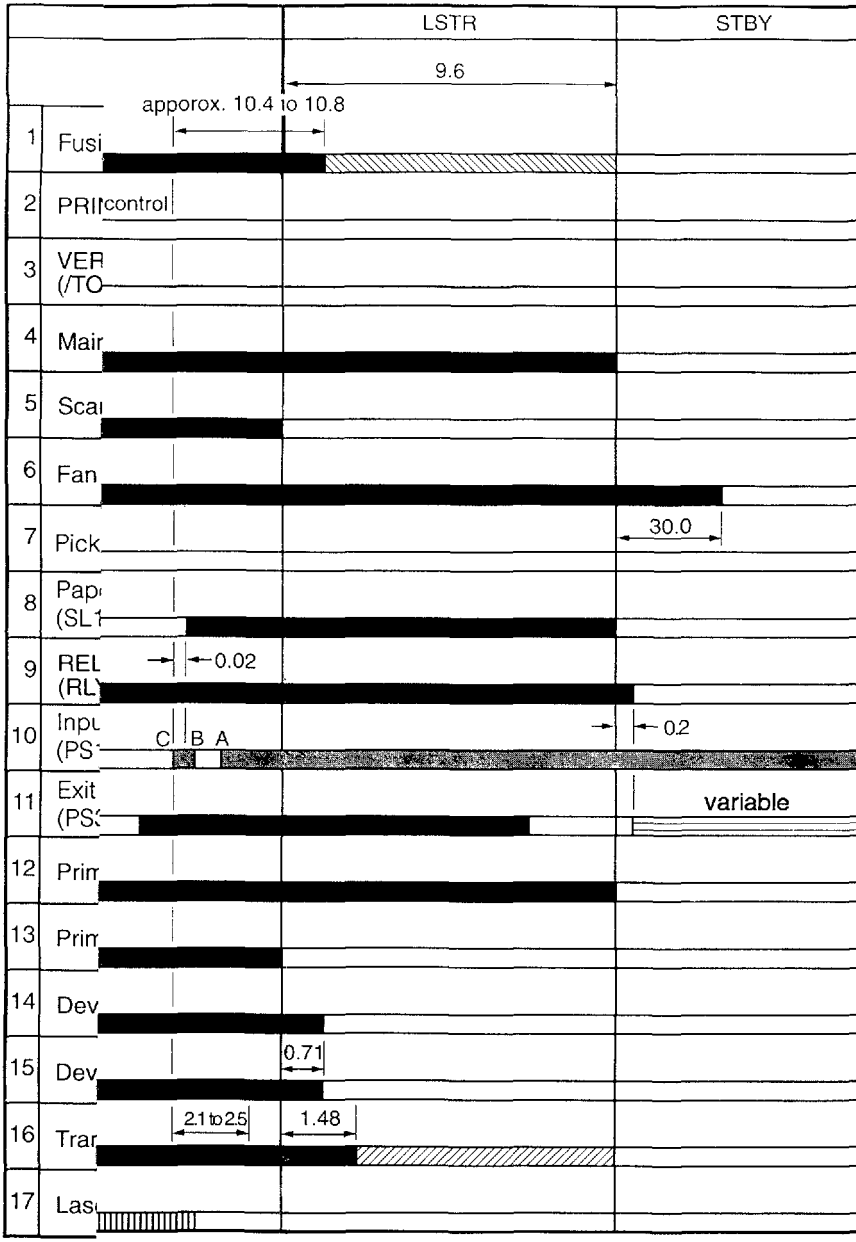
The Formatter PCA and the DC Controller PCA share information during printer operation. The DC Controller-to-Formatter Connector (DC Controller J201) forms a link which operates as a serial data bus. This allows printer status, command information, and dot-image data to be passed between the two PCAs. The following events take place during normal printer operation:

Table 5-3 Print Period Descriptions (refer to Timing Diagram)

PERIOD	TIMING	PURPOSE
WAIT	From power ON (power cord connection) to the end of Main Motor initial rotation.	Clear the drum surface potential and clean the Transfer Roller.
STBY (Standby)	From the end of the WAIT or the LSTR period until the input of the $\overline{\text{PRNT}}$ signal from the Formatter. Or from the end of the LSTR period until power OFF.	Maintain the printer in ready state.
INTR (Initial Rotation)	From the input of the $\overline{\text{PRNT}}$ signal from the Formatter until the laser diode intensity has been stabilized.	Stabilize the photosensitive drum sensitivity in preparation for printing. Also clean the Transfer Roller.
PRINT	From the end of initial rotation until the Scanner Motor stops.	Form images on the photosensitive drum based on the /VDO signal from the Formatter and transfer the image to paper.
LSTR (Last Rotation)	From the primary voltage (DC) OFF until the Main Motor stops. If another $\overline{\text{PRNT}}$ signal is sent from the Formatter, the printer returns to the INTR period. If not, it returns to the STBY period.	Deliver the last sheet of paper. Also clean the Transfer Roller.

General Timing Diagram

(Unit: second



6

Removal and Replacement

Removal and Replacement Strategy

This chapter documents removal and replacement of Field Replaceable Units (FRUs) only. Exchange assemblies should be sent to SMO for repair.

Unless specifically stated otherwise, these procedures apply to all four printer models (LaserJet 4L/4ML/4P/4MP). Replacement is generally the reverse of removal. Occasionally, notes are included to provide direction for difficult or critical replacement procedures.

WARNING! Unplug the power cord from the power outlet before attempting to service the printer. If this warning is not followed, severe injury may result.

Never operate or service the printer with the protective cover removed from the Laser/Scanner Assembly. The reflected beam, although invisible, can damage your eyes.

CAUTION The printer contains parts that are electrostatic discharge (ESD) sensitive. Always service printers at an ESD protected workstation.

To install a self-tapping screw, first turn it counter-clockwise to align it with the existing thread pattern, then carefully turn clockwise to tighten. **Do not over-tighten.** If a self-tapping screw-hole becomes stripped, repair of the screw-hole or replacement of the affected assembly is required.

Note Always remove the toner cartridge and the paper cassette from the printer before removing or replacing printer parts.

Required Tools

- #2 Magnetized Phillips Screwdriver (6-inch shaft)
- Small flat-blade Screwdriver
- Small Pair Needle Nose Pliers

All screws used in the printer are Phillips head screws which require a #2 size Phillips screwdriver. Figure 6-1 shows the difference between a Phillips and a Pozidriv screwdriver. Note that the Phillips tip has more beveled surfaces.

CAUTION A Posidriv screwdriver will damage the printer's screw heads. Use Phillips only.

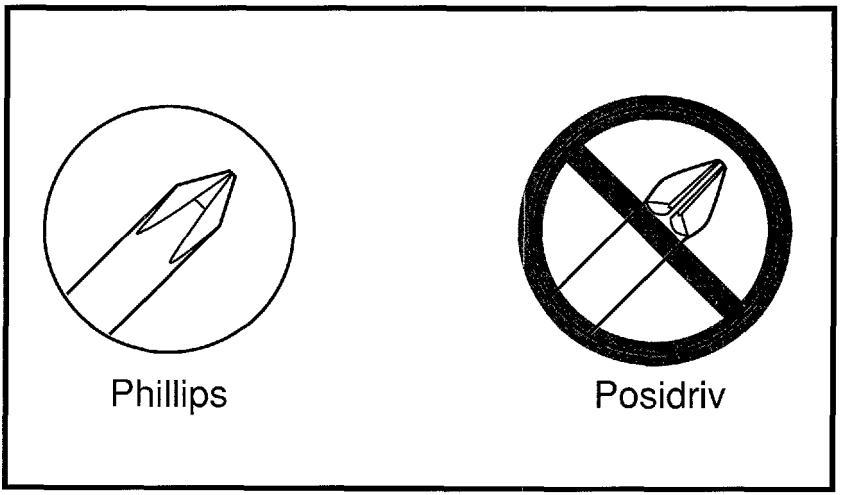


Figure 6-1 Phillips vs. Posidriv Screwdrivers

User Installable Assemblies

Memory Upgrade (LaserJet 4L)

The small access door on the left side of the printer allows access to the memory connector on the Formatter PCA.

CAUTION Memory modules must be removed prior to removing the Printer Cover to avoid possible damage to the memory, the Formatter PCA, or the DC Controller.

1. Open the Memory Door.
2. Pull outward on the small handle to unplug the memory assembly and remove.

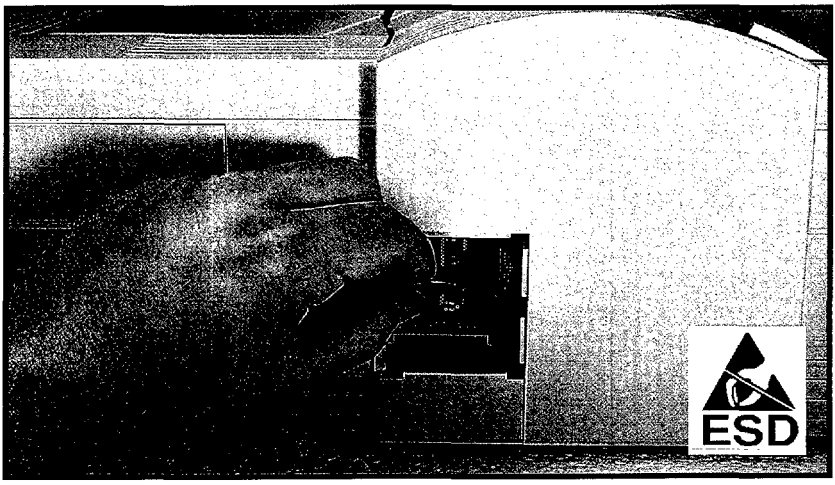


Figure 6-2 Removing the Memory Module (LaserJet 4L)

Memory/Language SIMMs (LaserJet 4P/4MP)

The SIMM slots are under an access panel on the left side of the printer. Place the printer on a firmly supported, flat surface.

1. Push downward forcefully on top of the access panel to release its clips from the main Printer Cover (Figure 6-3, callout 1).

2. Remove any SIMM modules (release side clips, tilt upward and lift out carefully).

CAUTION SIMM modules must be removed prior to removing the Printer Cover to avoid damage.

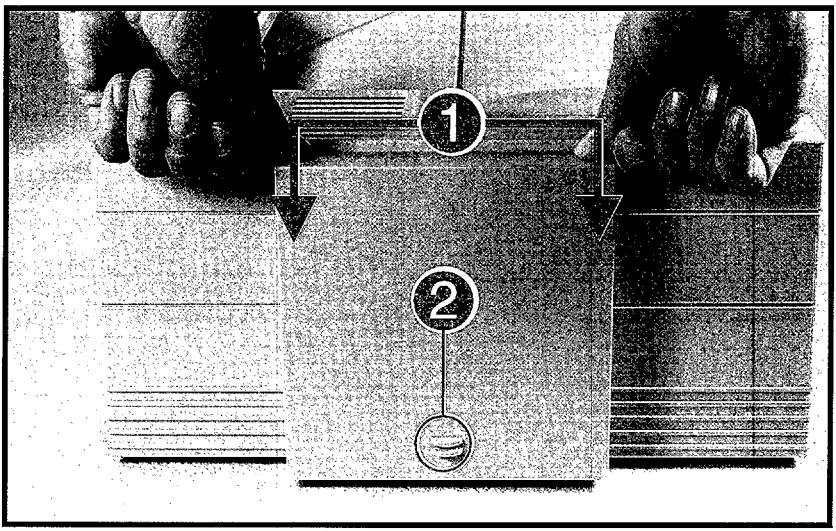


Figure 6-3 Removing the SIMM Access Panel (LaserJet 4P/4MP)

To re-install:
SIMM module can be installed in any available slot. Sequence is irrelevant. Install with the small notch toward the left. To re-install the access panel, hold it in place and lift firmly upward on the thumb grip (Figure 6-3, callout 2) to snap into place.

Cover and Doors

Power, I/O and Memory Doors (LaserJet 4L/4ML)

The Power Door is located on the right side of the printer. The I/O Door and Memory Door are on the left side (refer to Figure 1-2). Some doors are not hinged; and are removed simply by opening. Others (such as the Power Door) have a small hinge tab which holds the door in place. To remove the Power Door:

1. Open the door to a 90 degree angle.

2. Push the upper tab down slightly and tilt the door out (Figure 6-4).

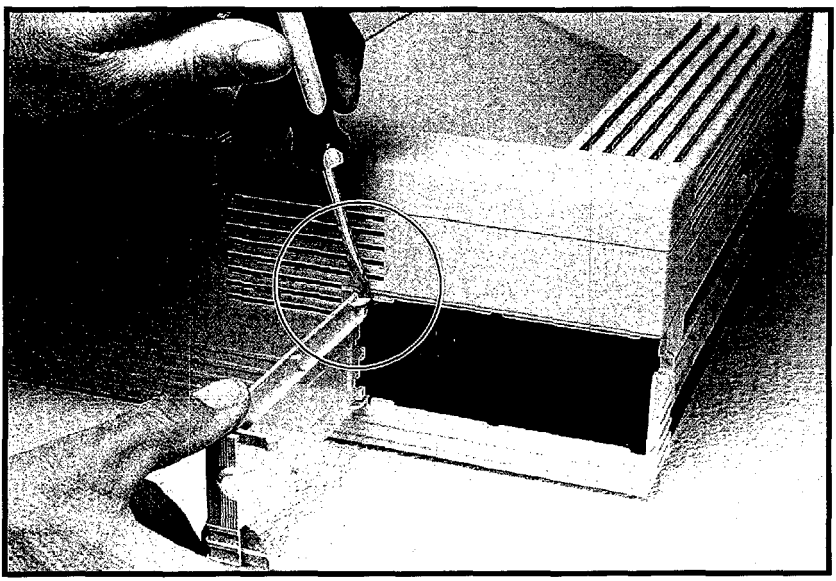


Figure 6-4 Removing the Power Access Door (LaserJet 4L/4ML)

Printer Cover (LaserJet 4L/4ML)

1. Remove the Power Door and unplug the power cord (Figure 6-4).

2. Remove the toner cartridge and paper cassette.

3. Remove any optional memory card (Figure 6-2).

CAUTION Step 3 is critical to avoid damage to the memory card, the Formatter PCA, and the DC Controller.

4. Unplug the parallel cable.

5. Remove the (4) self-tapping printer cover screws (Figure 6-5, callout 1).

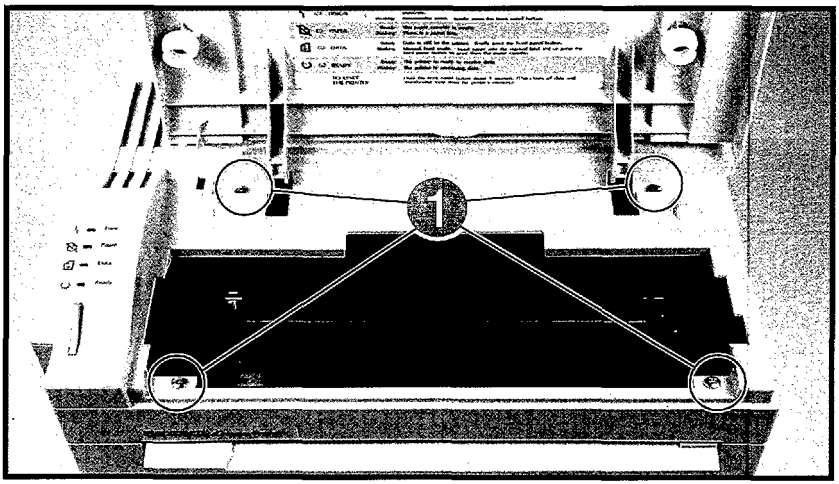


Figure 6-5 Removing the Printer Cover Screws (LaserJet 4L/4ML)

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6. With the Rear Door open, pull the lower rear tabs outward, away from the printer and lift upward slightly (Figure 6-6).

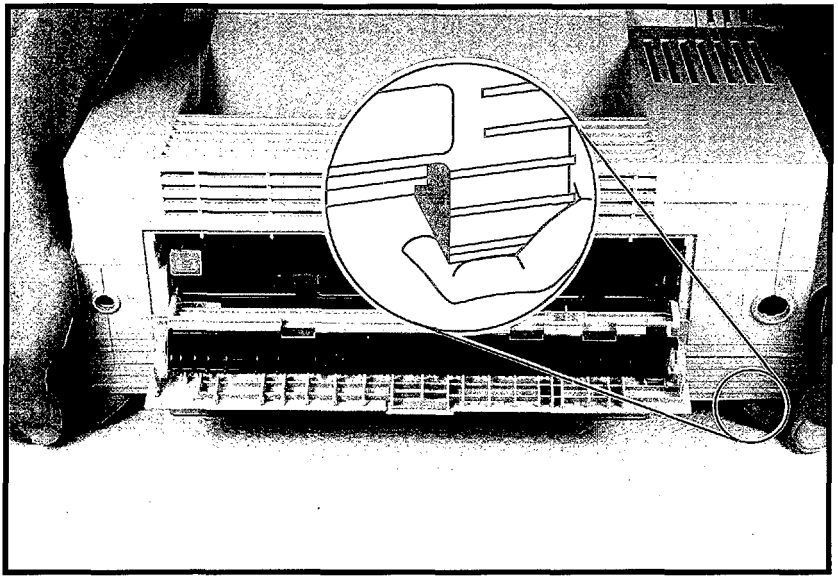

Figure 6-6 Releasing the Printer Cover Rear Tabs

7. Place a small object under the rear of the cover to keep it from snapping back in place. Pull the front lower front tabs outward, away from the printer chassis as in step 6 above.

8. Grasping the front and rear, lift the cover **straight up**, being careful to not catch any other assemblies while lifting.

CAUTION Avoid holding the cover by the more flexible left and right sides. Be careful to avoid catching the green Fuser Release Tab at the rear of the printer while lifting the cover off.

To re-install:
When reinstalling the Printer Cover, be sure the rear door is open. Lower the cover straight downward to avoid catching any parts.

Printer Cover (LaserJet 4P/4MP)

1. Unplug the power cord and interface cable(s).

2. Remove the toner cartridge and paper cassette.

CAUTION Steps 3 and 4 are critical to avoid damage to the SIMMs, the Formatter PCA, and cabling.

3. Remove the SIMM access panel and any installed SIMM modules (Figure 6-3).

4. Unplug the front panel cable connector (to the right of the topmost SIMM slot on the Formatter PCA - Figure 6-7).

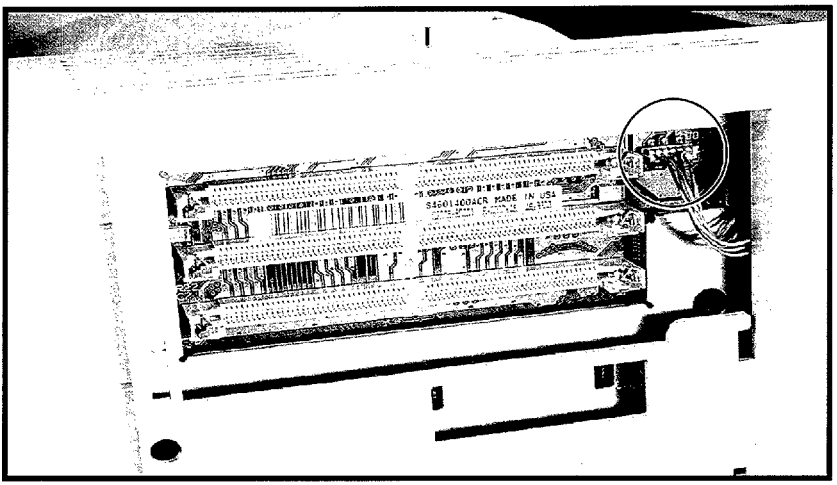

Figure 6-7 Control Panel Connector Location (LaserJet 4P/4MP)

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5. From the top of the printer, remove the (4) self-tapping screws (Figure 6-8, callout 1) and one machine screw (callout 2).

6. From the front of the printer, remove the one machine screw with star washer (Figure 6-8, callout 3).

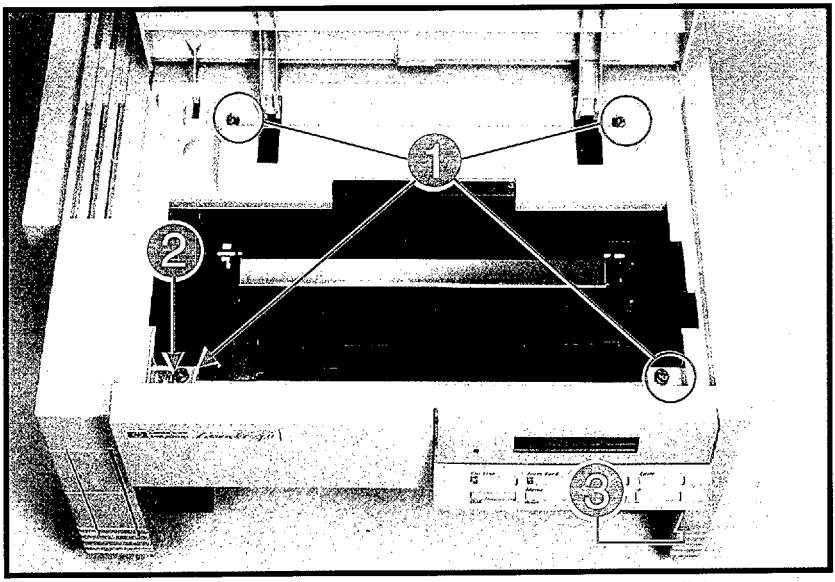

Figure 6-8 Removing the Printer Cover Screws (LaserJet 4P/4MP)

(continued on next page)

7. Turn the printer around so that the back edge hangs slightly beyond the edge of the table. Open the printer's rear door.

8. Pull outward on the two rear cover tabs to release pressure and lift slightly. Be sure to pull outward enough to clear the ac power receptacle (Figure 6-9, callout 1).

9. Reaching through the access hole (Figure 6-9, callout 2), pull outward to clear the power switch.

10. Turn the printer around and pull outward on the two front cover tabs to release pressure while lifting (Figure 6-9, callout 3). Once all cover tabs are free and the ac input and power switch are clear, lift the cover straight up carefully.

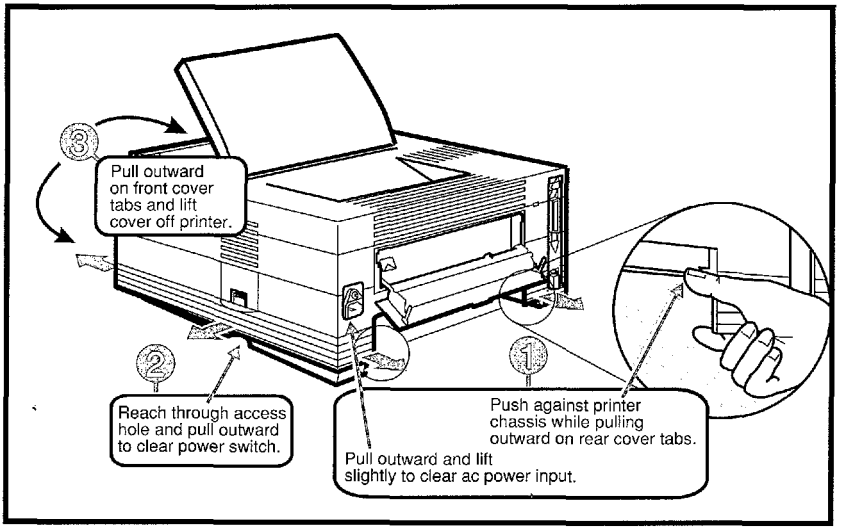

Figure 6-9 Removing the Cover (LaserJet 4P/4MP)

To re-install:
Ensure that the power switch is fully seated in its retaining slot. When lowering the cover over the chassis, be careful not to snag the parallel port bail lock (left rear), the ac power input (right rear), or the power switch. Watch positioning of the front cover tabs and the control panel cable. Re-connect the control panel cable and replace any SIMM modules that were removed.

Rear Door

The Rear Door provides access to the fuser area. The door is held in place by two flexible plastic tabs which mount into a groove on the rear of the Printer Cover.

1. Remove the Printer Cover and turn it upside down.

2. With the Rear Door open, gently bend the tab inward and down to release (Figure 6-10).

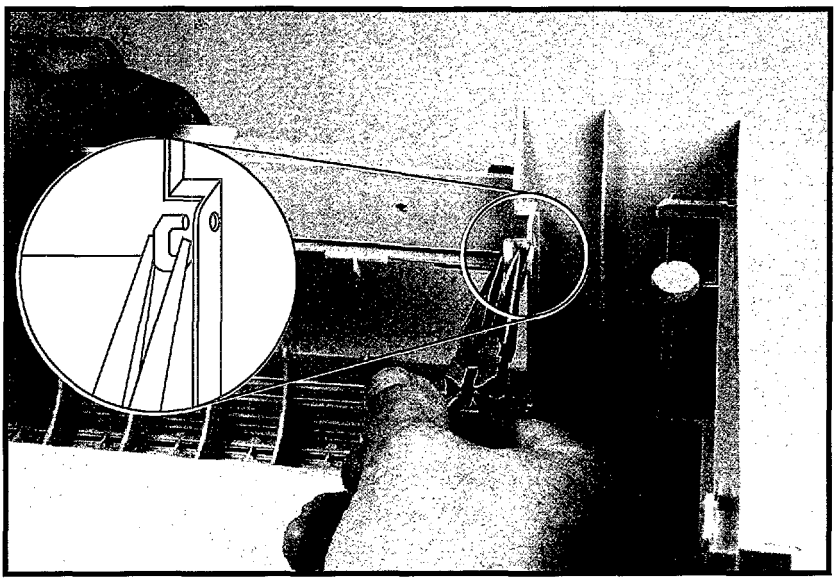

Figure 6-10 Removing the Rear Door

Control Panel (LaserJet 4P/4MP)

1. Remove the Printer Cover and turn it upside down.

2. Remove the (3) machine screws (one with star washer) (Figure 6-11, callouts 1 and 2).

3. Lift the Control Panel Assembly and unplug the connector from the PCA.

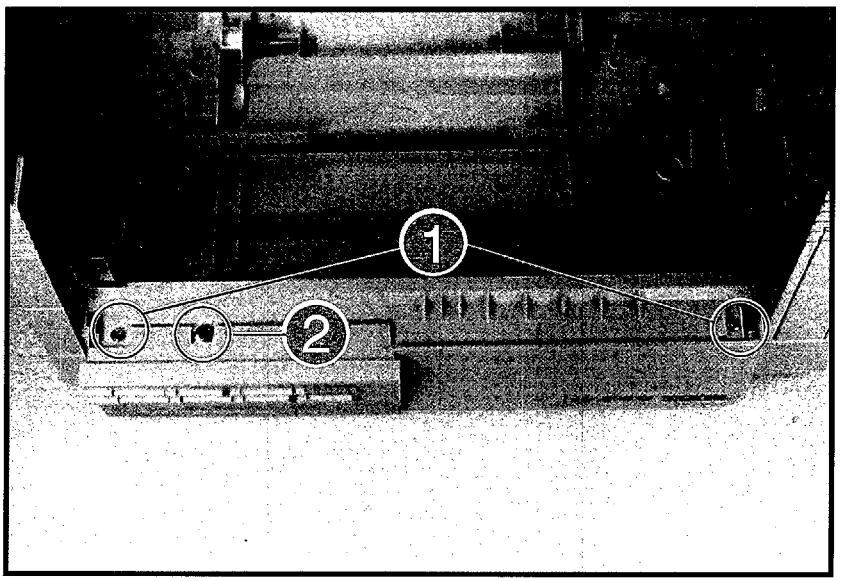

Figure 6-11 Removing the Control Panel Assembly (LaserJet 4P/4MP)

(continued on next page)

4. Remove the three self tapping RFI shield screws (Figure 6-12, callout 1) and one machine screw (callout 2).

5. The Control Panel PCA is located under the RFI shield. Remove its (3) self-tapping screws to replace the PCA.

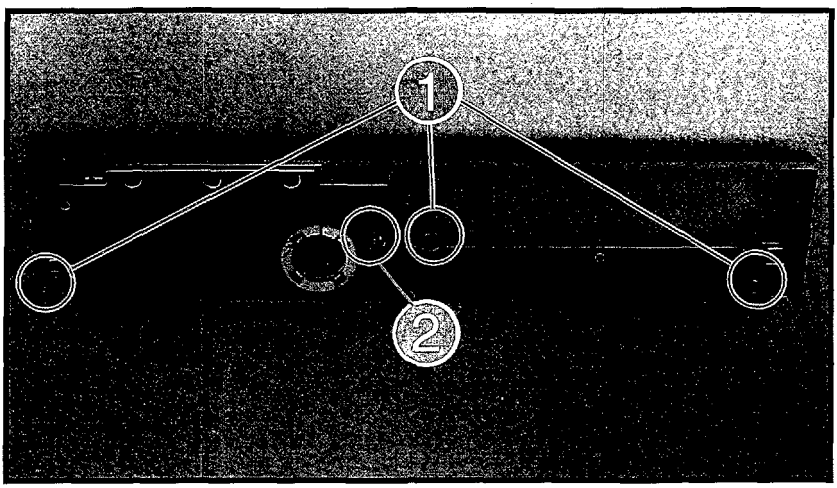

Figure 6-12 Control Panel RFI Shield (LaserJet 4P/4MP)

To re-install:
Before reassembly, ensure that the control panel cable is properly routed within its cable guides.

Left Side Assemblies

Formatter Shield and PCA

The Formatter PCA is located under a metal RFI shield on the left side of the printer.

CAUTION Use proper ESD precautions when removing the Formatter PCA. Avoid touching components and use an anti-static bag for storage or shipping.

1. Remove the Printer Cover.
2. Remove the screws that hold the RFI shield in place and lift the shield off (Figure 6-13, callout 1 for LaserJet 4L).
3. Remove any remaining screws on the Formatter PCA (Figure 6-13, callout 2 for LaserJet 4L).

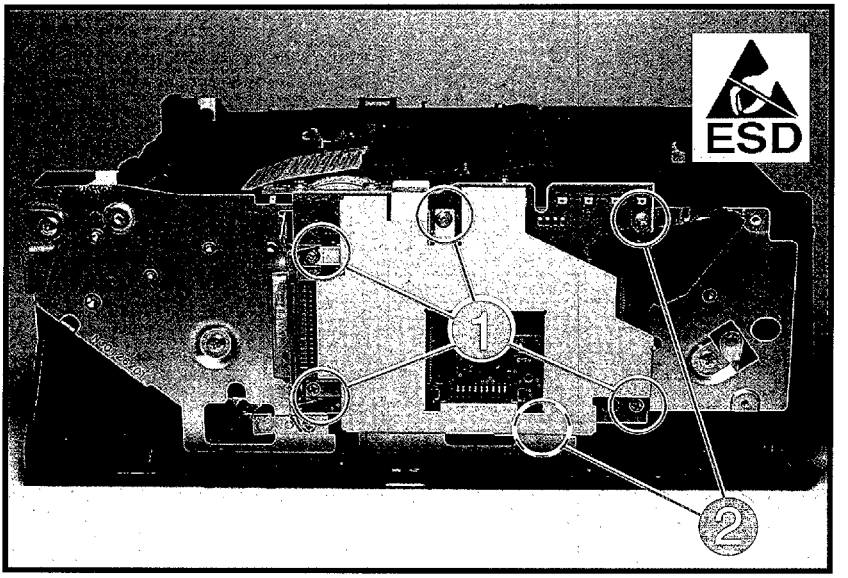

Figure 6-13 Removing the Formatter Shield and PCA (LaserJet 4L shown)

4. Grasp the Formatter PCA near the center and pull straight out (the PCA is plugged into the DC Controller through the connector in the lower center area).

Note When replacing the Formatter PCA, remove and transfer the Formatter to DC Controller Connector Extension (all printers) and the Switch Actuator (LaserJet 4L/4ML) to the new PCA. Procedures are shown below.

5. To remove the connector extension, squeeze the tabs on either side and pull the Extension straight out the rear of the PCA (Figure 6-14, callout 1).
6. *LaserJet 4L / 4ML:* Squeeze the tabs on the Switch Actuator and pull it straight out from the back side of the Formatter PCA (Figure 6-14, callout 2).

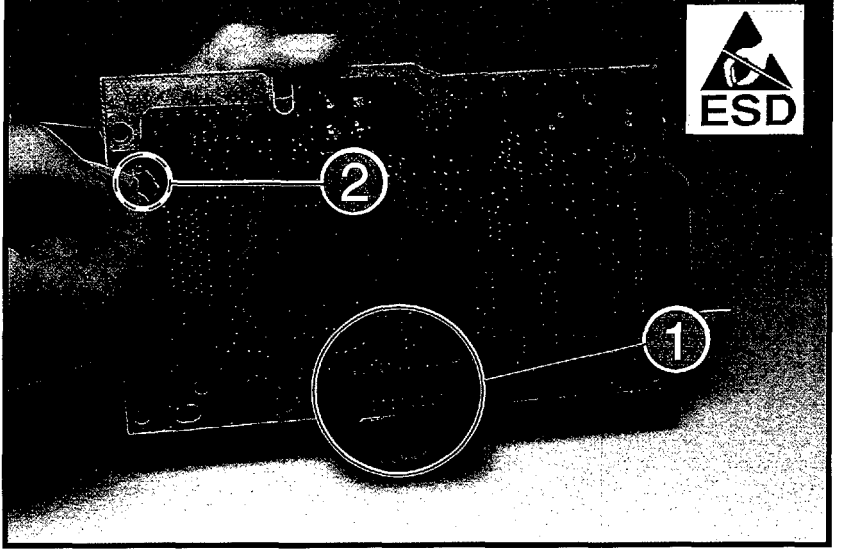

Figure 6-14 DC Controller Connector & Switch Actuator (LaserJet 4L shown)

Gear Train Assembly

The Gear Train Assembly is located on the left side of the printer, under the Formatter PCA. The steps and pictures here are for the LaserJet 4L/4ML. The LaserJet 4P/4MP is slightly larger but very similar.

1. Remove the Printer Cover and Formatter PCA (Figure 6-13).
2. Loosen (do not remove) the (2) upper self-tapping Main Motor screws (Figure 6-15, callout 1).
3. Through the access holes (Figure 6-15, callout 2), remove the (2) screws securing the Gear Train grounding springs (small diameter machine screws with captive star washers). These screws are connected to the DC Controller Assembly.
4. Remove the (6) self-tapping screws (Figure 6-15, callout 3).
5. Pull the Gear Train Assembly straight out to remove. Keep the gear side of the assembly face up (gears are held in place by light pressure only and may fall off if the assembly is tilted).

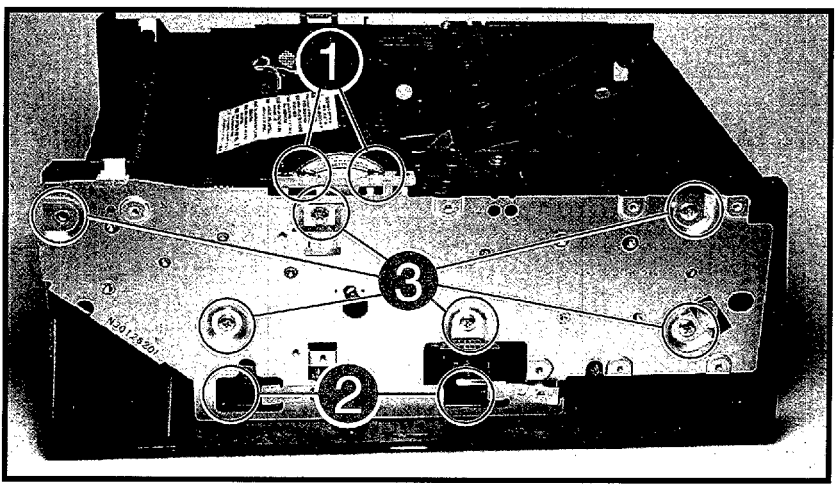

Figure 6-15 Removing the Gear Train Assembly (LaserJet 4L shown)

(continued on next page)

To re-install:

1. Maneuver the assembly back in place, rotating some of the gears slightly to mesh, if necessary.

2. Tighten the screws beginning in the center and working outward (Figure 6-16).

CAUTION Do not tighten the upper two Main Motor screws until the Main Motor and Gear Train are both in place. Tightening the screws without the Main Motor in place can damage the mount.

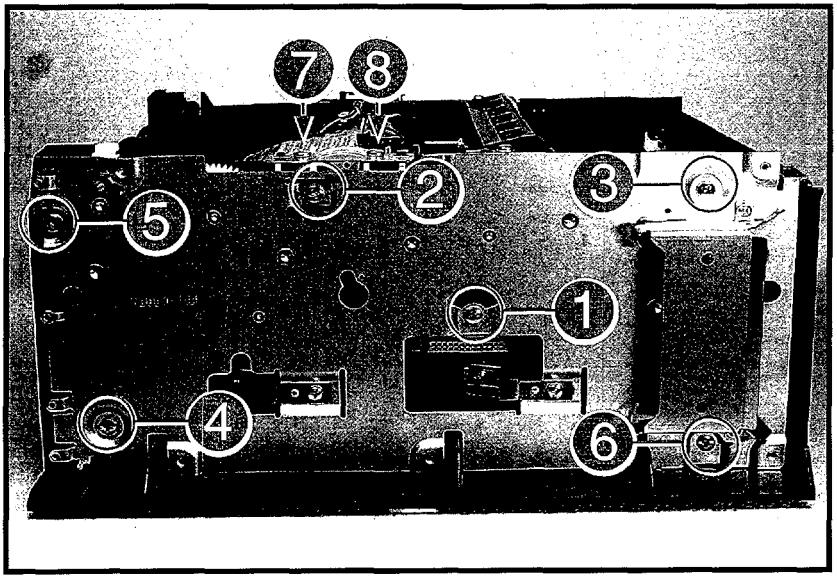

Figure 6-16 Screw Tightening Sequence Example (LaserJet 4P shown)

Main Motor

1. Remove the Printer Cover, and the Formatter Shield and PCA (Figure 6-17).

2. Remove the (1) machine screw through the access hole on the Gear Train Assembly, approximately two (2) inches below the top of the Main Motor (Figure 6-17, callout 1).

3. Remove the (2) self-tapping screws at the top of the Main Motor and pull the Main Motor straight up and out (Figure 6-17, callout 2).

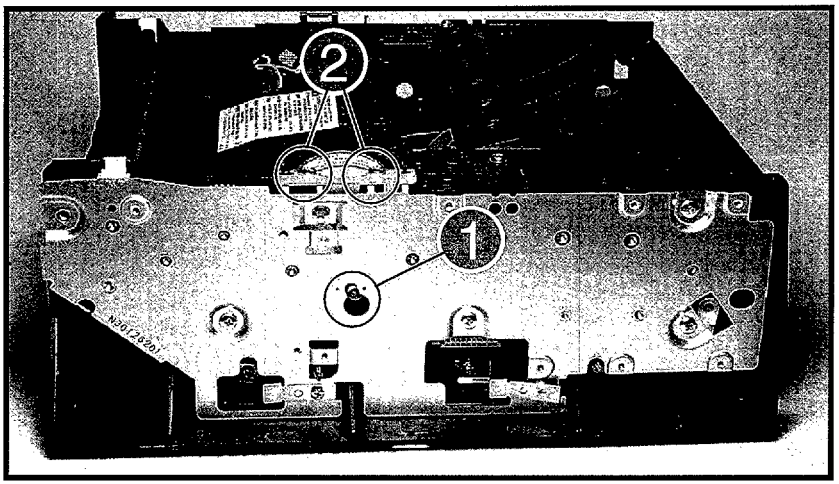

Figure 6-17 Removing the Main Motor (LaserJet 4L shown)

Front Assemblies

Front Oblique Roller Assembly

The Front Oblique Roller Assembly is located on the front of the printer, and is accessible after removing the Paper Cassette. It can be removed without removing the Printer Cover.

1. Remove the Paper Cassette.

2. Remove the (1) self-tapping screw on the left of the Front Oblique Roller Assembly and tilt the assembly out at the bottom to remove (Figure 6-18, callout 1).

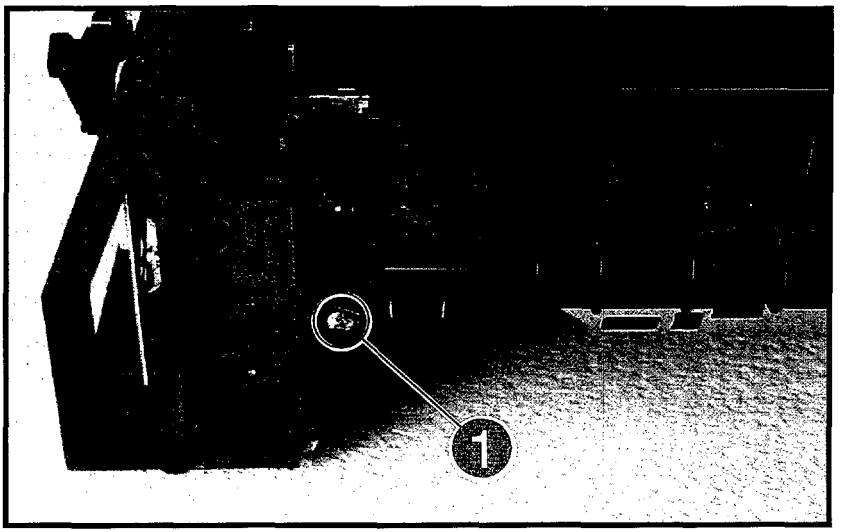

Figure 6-18 Removing the Oblique Roller Assembly

Paper Cassette Assembly

Field replaceable parts on the Universal Paper Cassette include: the Tray Forms Size Guide(s), two compression springs.

Tray Forms Size Guide (LaserJet 4L/4ML)

Note The forms size guides on the LaserJet 4P/4MP are very easily removed and are not shown here.

1. Remove the Paper Cassette from the printer and unload paper.
2. Slide the guide all the way to the left and forward (near the "B5" adjustment line).
3. Lift the inside corner up slightly while twisting the guide in a clockwise direction. This frees the tab on the back side of the cassette, allowing removal.

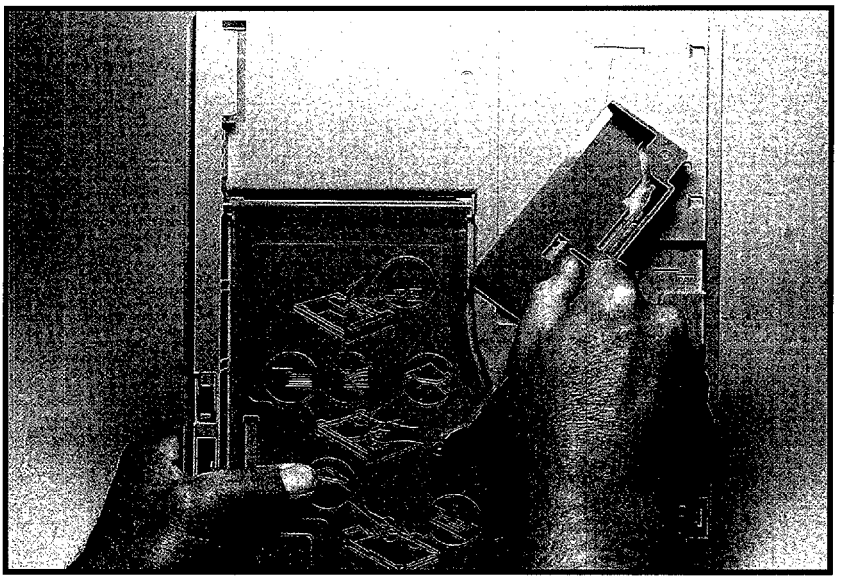

Figure 6-19 Removing the Tray Forms Size Guide (LaserJet 4L/4ML shown)

Compression Springs

The Paper Cassette compression springs are located under the large pressure plate. The LaserJet 4L/4ML is shown here. Removal procedures for the LaserJet 4P/4MP are very similar.

1. Remove the Paper Cassette from the printer and unload paper.

2. Release the plastic latch on the lower left corner of the cassette assembly (Figure 6-20). Rotate the metal bar up and out of the way.

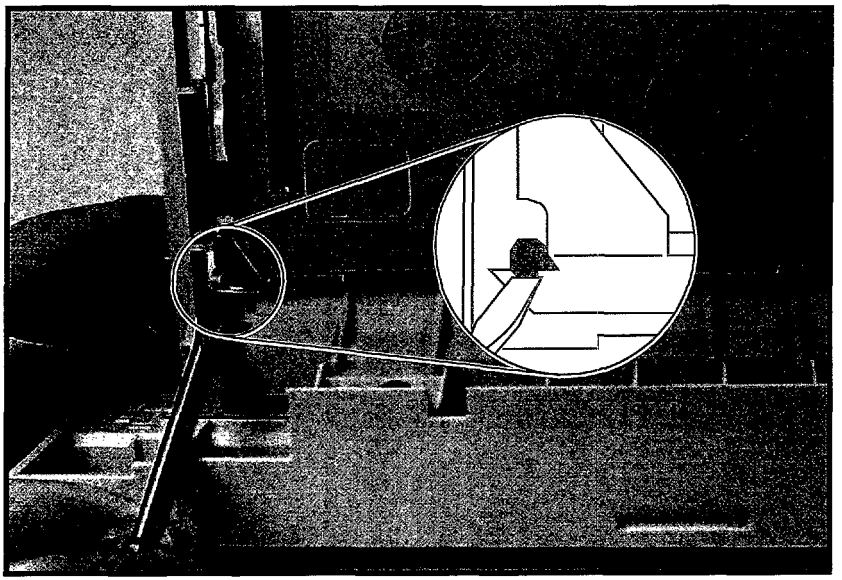

Figure 6-20 Removing the Paper Cassette Assemblies

3. Release the large pressure plate from the catches on both sides (LaserJet 4L/4ML only). Raise the plate all the way up to access the compression springs.

To re-install:
Before lowering the pressure plate back into place, be sure that the larger compression spring on the left side will be seated properly on the underside of the plate.

Internal Assemblies

Laser/Scanner Assembly

1. Remove the Printer Cover.
2. Lift the foam cover and unplug the Fan connector (Figure 6-21, callout 1). (The Fan's power is via the Laser/Scanner Assembly.)
3. Remove the (3) self-tapping screws (Figure 6-21, callout 2).

Note The uppermost screw in Figure 6-21, callout 2, is under a protective light shutter. Do not remove the scanner cover screw (crossed circle in Figure 6-21). There are no field replaceable parts inside the Laser/Scanner Assembly.

4. Lift the Laser/Scanner Assembly at both ends to remove (there may be some connection resistance - Figure 6-21, callout 3).

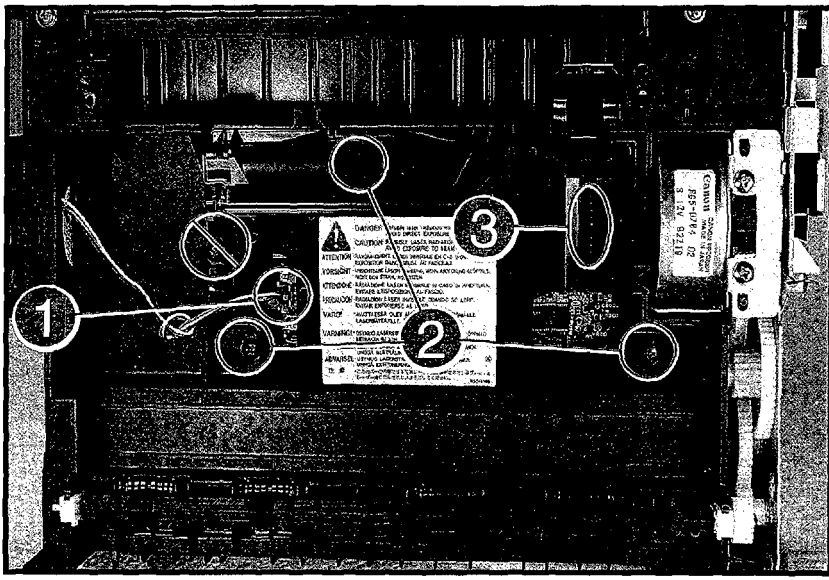

Figure 6-21 Removing the Laser/Scanner Assembly

Fan

1. Remove the Printer Cover.

2. Lift the foam cover and unplug the Fan connector from the Laser/Scanner Assembly (Figure 6-21, callout 1).

3. Pull down on both sides of the plastic bottom tab (use a flat-blade screwdriver on the LaserJet 4P/4MP) and tilt the bottom of the fan outward (Figure 6-22, callout 1).

4. With the bottom tab released, pull upward on the top tab to remove (Figure 6-22, callout 2).

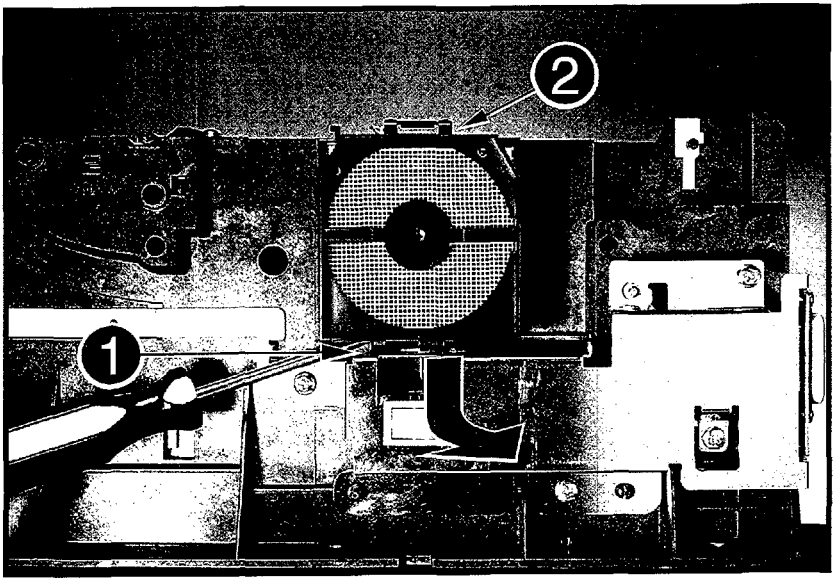

Figure 6-22 Removing the Fan (LaserJet 4P/4MP shown)

Power Switch Assembly (LaserJet 4P/4MP only)

The Power Switch assembly is mounted on the right side of the printer chassis, below the fan.

1. Remove the Printer Cover.
2. Remove the (3) self tapping screws (Figure 6-23, callout 1).
3. Remove the (2) machine screws (Figure 6-23, callout 2), and pull the Power Switch Assembly outward to unplug from the DC Controller.

Note To access the second machine screw, it may be necessary to re-seat the power switch fully downward in its retaining slot (if it was dislodged during cover removal).

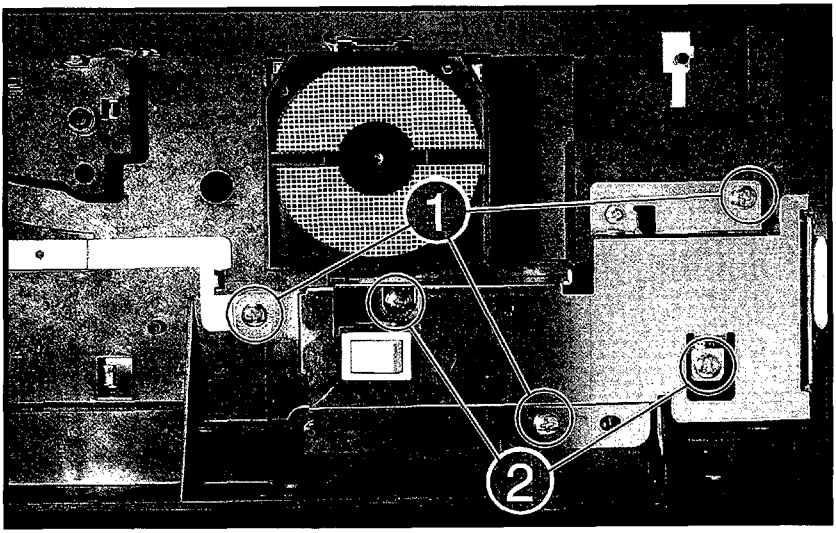

Figure 6-23 Removing the Power Switch Assembly (LaserJet 4P/4MP)

Paper Guide/Top Oblique Roller Assembly

The assembly is held in place by one self-tapping screw, two plastic alignment tabs, and a plastic latch tab.

Note It is not necessary to remove the Printer Cover, although the front alignment tabs (Figure 6-24, callout 2) are more easily accessible with the cover removed.

1. Remove the (1) self-tapping screw on the left side of the assembly (Figure 6-24, callout 1).

2. Lift the rear of the assembly while pushing down at the front, and pull it to the rear slightly (this releases the tabs - Figure 6-24, callout 2).

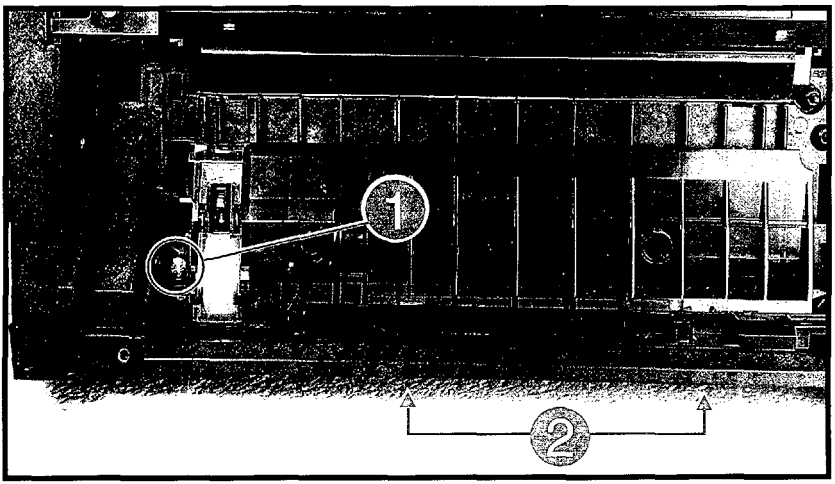

Figure 6-24 Removing the Paper Guide/Roller Assembly

To re-install:
Ensure that the Guide Assembly is under the top door release button plunger and that the two tabs are in place.

Transfer Roller and Guide

The Transfer Roller is located inside the top door, under the toner cartridge. The Printer Cover does not need to be removed to replace the Transfer Roller.

CAUTION Do not touch or otherwise contaminate the surface of the Transfer Roller. Skin oils and other contaminants affect its electrical characteristics, resulting in poor image transfer.

1. Open the top door and remove the toner cartridge.
2. Using a flat-blade screwdriver, gently pry under the left end to lift the roller shaft upward (Figure 6-25, callout 1).

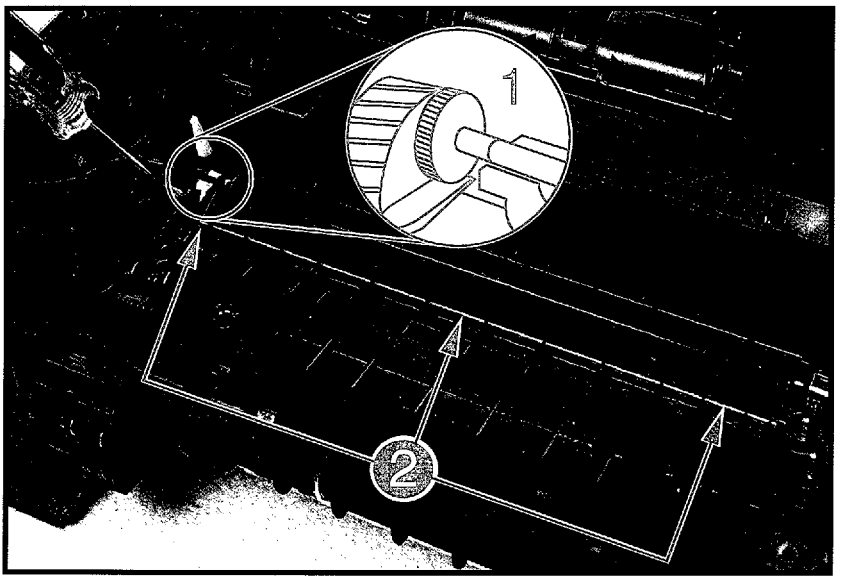

Figure 6-25 Replacing the Transfer Roller

(continued on next page)

3. Lift the Transfer Roller and Guide slightly and slide toward the left to remove. Do not lift the roller more than about 1 inch (2.5 cm) before sliding it out of the right bushing.

4. Pull the Roller shaft out of the clips on the Transfer Roller Guide to release the Transfer Roller from the Guide.

Note If replacing just the Transfer Roller Guide, be careful not to lose the Transfer Roller gear. It is only held in place by slight pressure and can fall off the Roller shaft.

To re-install:
Install the right end first. Ensure that the tabs are seated firmly in place below the plastic guide (Figure 6-25, callout 2), and push the Transfer Roller into place.

Transfer Roller Bushings

The Transfer Roller Bushings are located under the left and right ends of the Transfer Roller (refer to Figure 6-25). It is not necessary to remove the Printer Cover to replace the bushings.

1. Open the top door and remove the toner cartridge.

2. Remove the Transfer Roller (Figure 6-25).

3. Remove the (1) self-tapping screw and lift the bushing straight out (the same procedure applies for both the left and right bushings).

Beam-to-Drum Mirror Assembly

Note Be careful not to touch the surface of the mirror on the underside of the assembly. If the mirror does get contaminated, use filtered, compressed air to clean. If still dirty, clean it carefully using lens cleaner and a lint free cloth or swab.

1. Remove the Printer Cover.
2. Note where the mark on the printer chassis aligns with the graduated scale on the mirror (Figure 6-26, callout 1).
3. Remove the (2) self-tapping screws (Figure 6-26, callout 2). Grasp the mirror assembly by the sides only, and lift to remove.

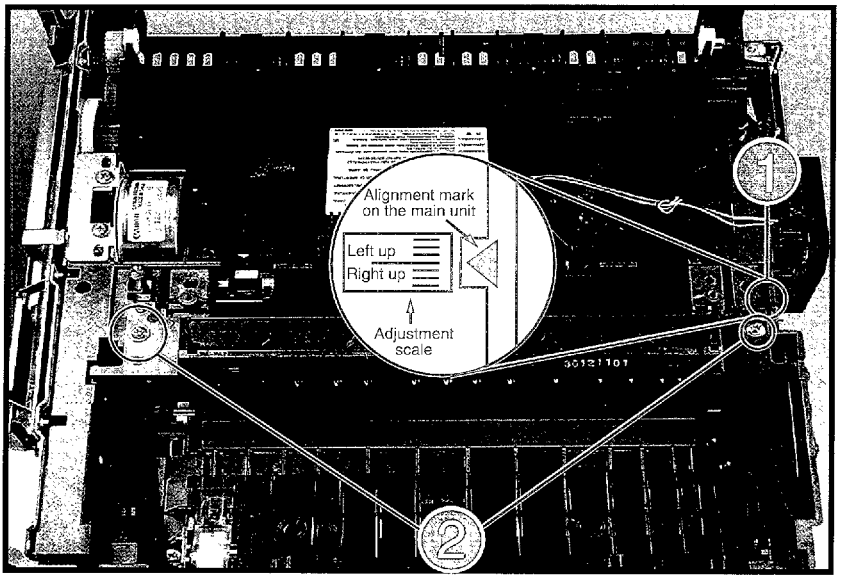

Figure 6-26 Removing the Beam-to-Drum Mirror

To re-install:
Install in the correct alignment as noted in step 2. Check adjustment according to the "Beam-to-Drum Mirror Adjustment" procedure in Chapter 7.

Rear Assemblies

Fusing Assembly

1. Remove the Printer Cover.

2. Remove the machine screws with star washers (1 on 4L/4ML, 2 on 4P/4MP) (Figure 6-27, callout 1).

3. Remove the (2) self-tapping screws (Figure 6-27, callout 2).

4. Slide the Fusing Assembly straight out from the rear of the unit (some resistance may be encountered because of the two connectors to the DC Controller).

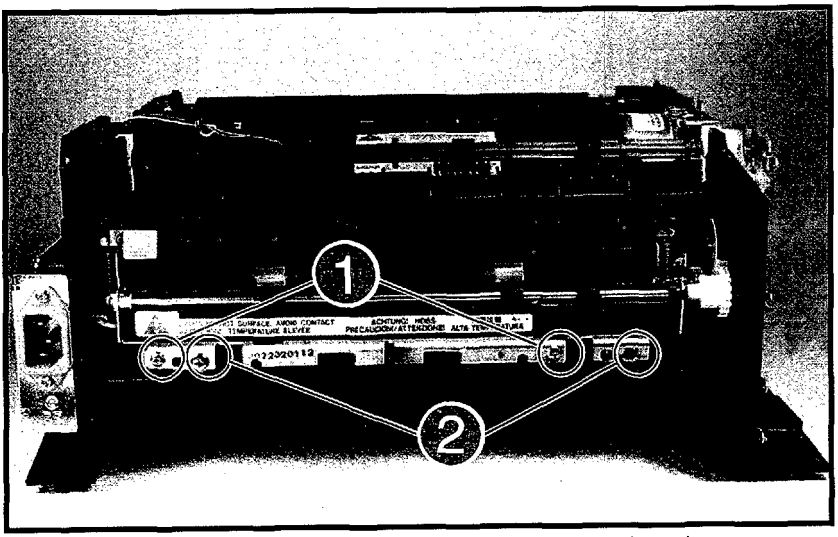

Figure 6-27 Removing the Fusing Assembly (LaserJet 4P shown)

Fusing Assembly Components

The following procedure describes the steps for disassembling the Fusing Assembly (after it has been removed from the printer). Please perform the steps in the sequence listed.

Pressure Plate

CAUTION Do not remove or disturb the (2) stationary compression springs located at either end on top of the pressure plate. Dislocation of these springs can cause poor fusing.

1. Remove the spring from each end of the Pressure Plate (Figure 6-28, callout 1).

2. Open the Pressure Plate more than 90 degrees and lift it off its hinges.

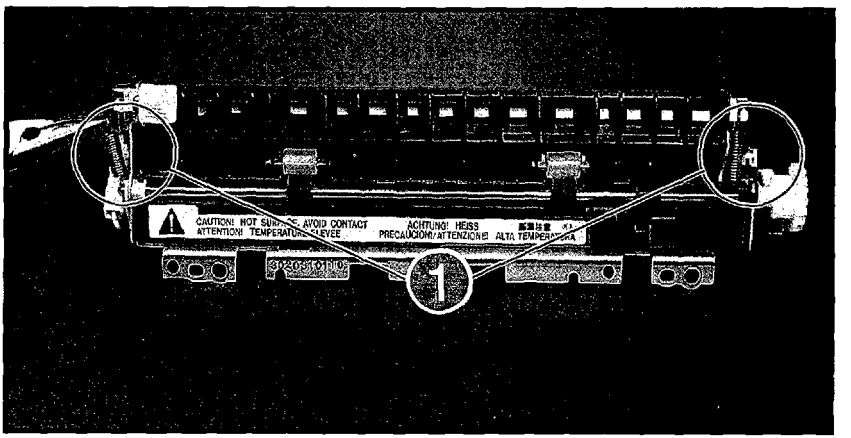

Figure 6-28 Removing the Fusing Pressure Plate

Upper Fusing Assembly (Teflon Sleeve and Heater Element)

1. Unsnap and open the cable clip shown in Figure 6-29, callout 1.
2. Remove the wires from the open cable clip and gently squeeze the connector to unplug.
3. Unplug the second connector shown in Figure 6-29, callout 2.
4. Squeeze the tab on the ceramic heater element connector and pull the connector free (Figure 6-29, callout 3).
5. Grip both ends of the Upper Fusing Assembly, lifting it out.

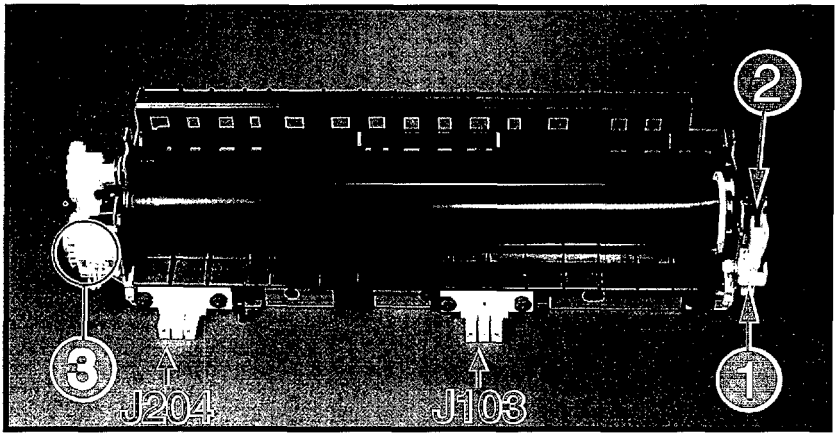

Figure 6-29 Removing the Upper Fusing Assembly

Pressure Roller

NOTE — The plastic bushings under each end of the Pressure Roller can fall out of place and be easily lost.

1. The Pressure Roller is now free. Grasp both ends and lift it out.

Delivery Assembly

1. Pull out gently on the metal frame on either end of the Delivery Assembly to release the mounting pins. Lift the assembly out (Figure 6-30).

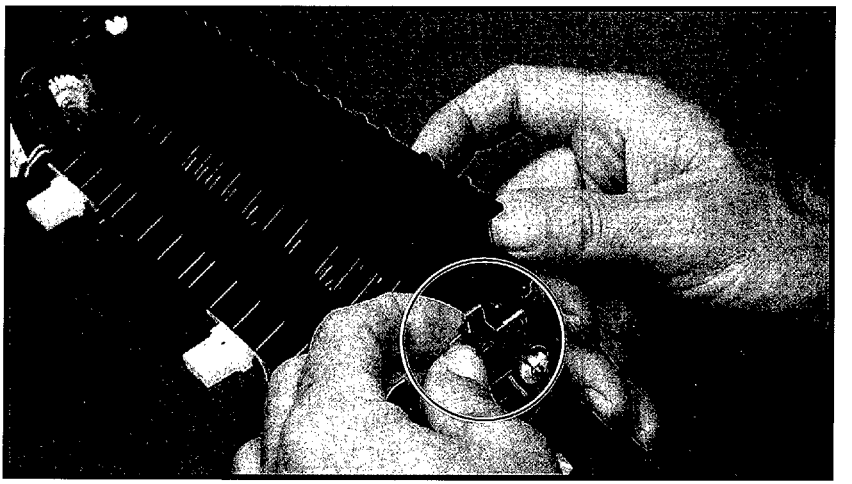

Figure 6-30 Removing the Fuser Delivery Assembly

To re-install:
Ensure that the assembly is installed with its white plastic pressure rollers **toward the back of the Fusing Assembly, adjacent to the Lower Delivery Rollers.** It is possible to install the Delivery Assembly backwards.

Lower Delivery Roller

1. Lift up on the bushing tab and slide the shaft inward and out of the bushing (Figure 6-31, callout 1).

2. Slide the bushing out from the metal frame and slide the Lower Delivery Roller out (Figure 6-31, callout 2).

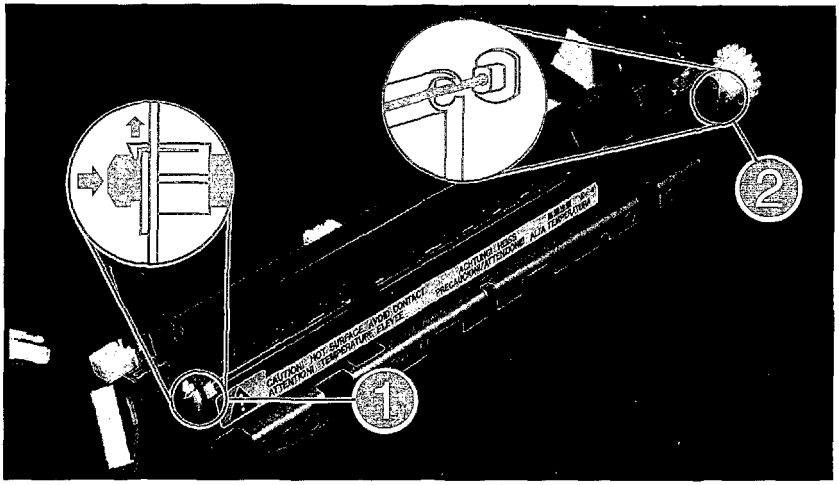

Figure 6-31 Removing the Lower Delivery Roller

Lower Delivery Guide/Exit Sensor Flag

1. Slide the Lower Delivery Guide slightly back to clear the center tab and lift the guide out, being careful not to damage the Exit Sensor Flag.

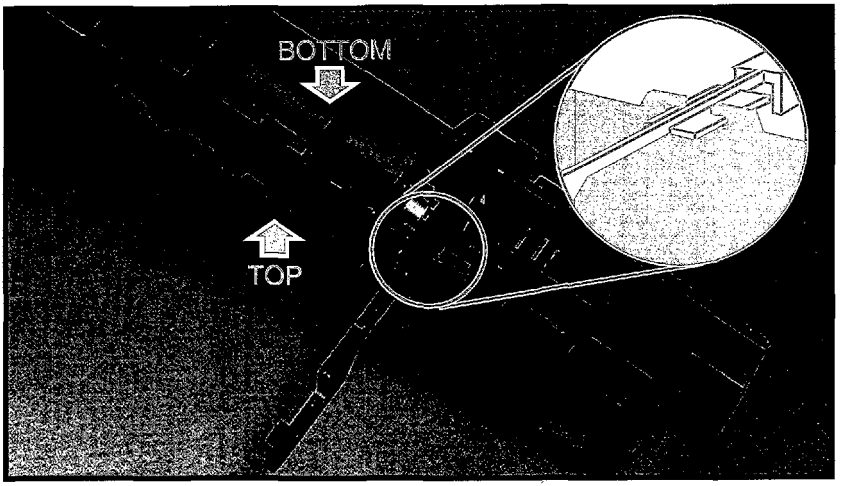

Figure 6-32 Removing the Lower Delivery Guide and Exit Sensor Flag

To re-install:
Be certain to install Exit Sensor Flag into its groove (Figure 6-32).

Connector Assembly (Fuser Entrance Guide)

1. Remove the connector wires from each end of the Connector Assembly (Figure 6-33, callout 1).

2. Gently squeeze the cable clip tabs using needle nose pliers and slide the cable clip out of the frame (Figure 6-33, callout 2).

3. Remove the (1) machine screw (Figure 6-33, callout 3).

4. Slide the Connector Assembly toward the cable clip location and lift out.

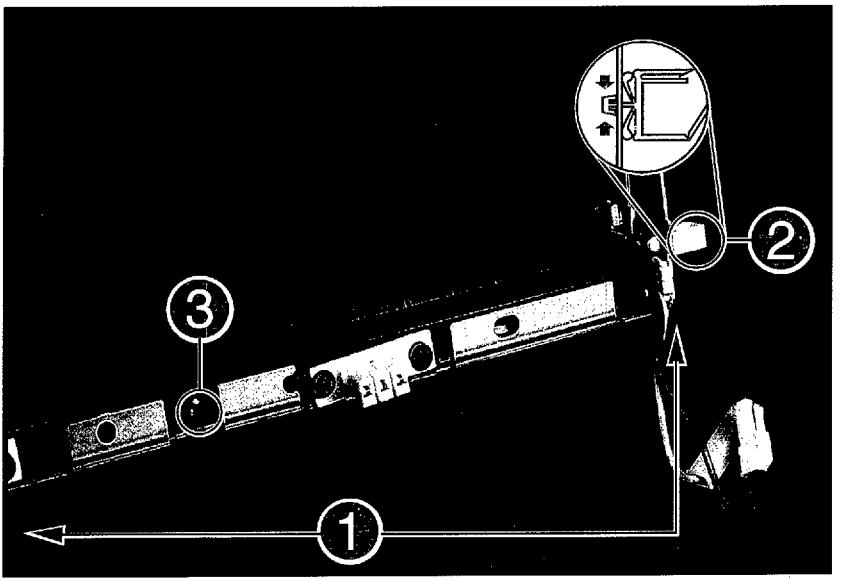

Figure 6-33 Removing the Fuser Connector Assembly

To re-install:
Be certain to correctly align the wires that run inside of the Connector Assembly to avoid damage.

Upper Output Roller Assembly

1. Remove the Printer Cover.

2. Using a flat-blade screwdriver, release the two-sided tabs from each end of the Roller Assembly (Figure 6-34).

3. Lift the Upper Output Roller Assembly out to remove.

CAUTION Be careful not to lift one end of the shaft more than about 1/2 inch (1 cm) before both ends have been released, as this will break the shaft.

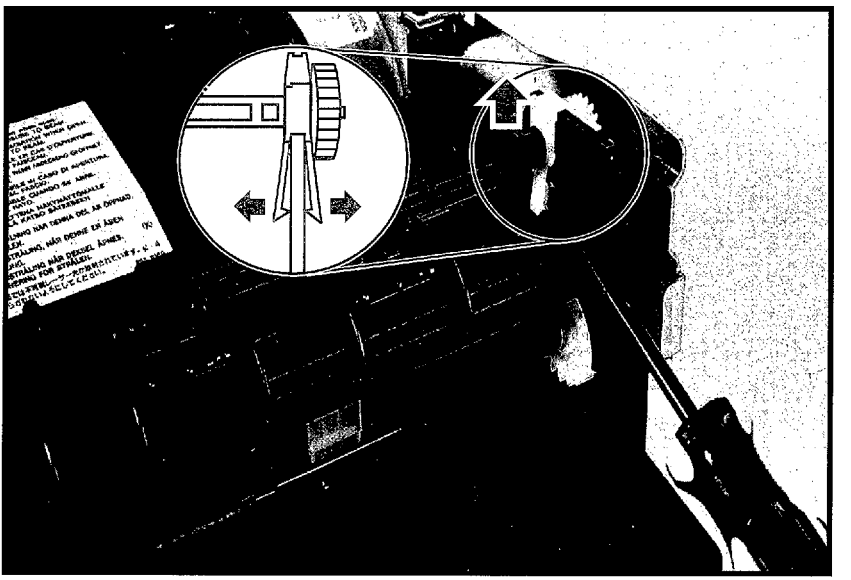

Figure 6-34 Removing the Upper Output Roller Assembly

Lower Output Rollers

There are four separate output rollers located directly below the Upper Output Roller Assembly. Each roller is held in place by three pressure tabs.

1. Remove the Printer Cover.

2. Remove the Upper Output Roller Assembly (Figure 6-34).

3. Push either the left or right tab inward, tilt the Output Roller and lift upward to remove (Figure 6-35). Use the same procedure for all four rollers.

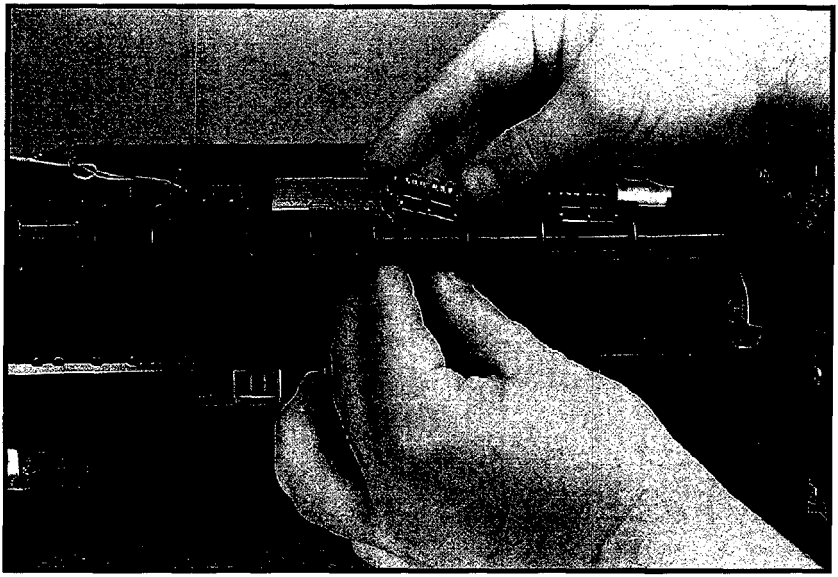

Figure 6-35 Removing the Lower Output Rollers

Bottom Assemblies

DC Controller Assembly

The DC Controller Assembly is located on the bottom of the printer. The PCA is protected by a metal shield assembly, and is mounted to a plastic base. The Formatter PCA and Fusing Assemblies are connected directly into the DC Controller and must be removed prior to removal of the DC Controller Assembly.

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), and the Power Switch Assembly (*LaserJet 4P/4MP only* - Figure 6-23).

CAUTION

Failure to remove all the above components before removing the DC Controller will result in printer damage.

2. Remove the (2) screws that attach the grounding springs to the Gear Train Assembly (Figure 6-36, callout 1).

3. Remove the (5) self-tapping screws and the (1) machine screw from the bottom of the DC Controller Assembly (Figure 6-36, callouts 2 and 3). Do not remove the Pickup Solenoid screw (crossed circle in Figure 6-36).

4. Push the Pickup Feed D-Roller solenoid arm in and rotate the D-Roller down, clear of the solenoid arm (Figure 6-36, callout 4).

5. Grasp the rails on either side of the DC Controller Assembly and lift the assembly out, being careful not to catch the solenoid arm on the Pickup Feed D-Roller.

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Note When removing the DC Controller Assembly there will be resistance where the connectors are attached (on the left in Figure 6-36). A firm tug may be necessary to free the assembly.

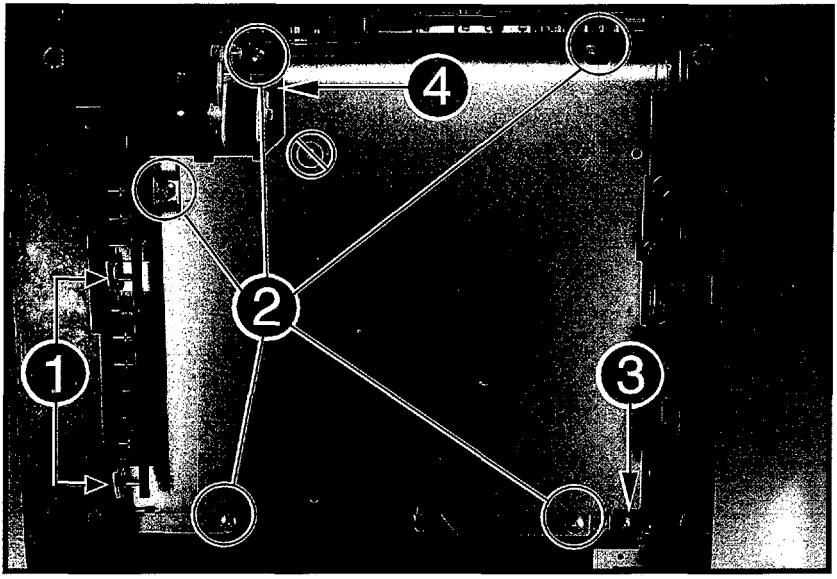

Figure 6-36 Removing the DC Controller Assembly

To re-install:
When reinstalling the DC Controller, be sure to use a short length (6 mm) machine screw at Figure 6-36, callout 3. A longer (10 mm) screw will obstruct the Fusing Assembly.

Ensure that the PS1 Input Paper Sensor Arm (Figure 6-51), and the PS2 Paper-out Sensor Flag on the D-Roller Assembly (Figure 6-41, callout 2) are in their proper positions. The Input Paper Sensor Arm should operate freely. If either of these are not seated properly, this will cause a continuous Paper Jam error condition.

Pickup Solenoid (SL2)

The Pickup Solenoid (SL2) is located on the DC Controller PCA.

1. Remove the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), and Power Switch Assembly (*LaserJet 4P/4MP only* - Figure 6-23), and the DC Controller Assembly (Figure 6-36).
2. Remove the (1) machine screw holding the Pickup Solenoid from the lower side of the DC Controller Assembly (the crossed circle shown in Figure 6-36).
3. Unplug the Pickup Solenoid connector (Figure 6-37, callout 1) and remove the solenoid (Figure 6-37, callout 2).

Note Be careful not to lose the small metal grounding tab that fits over the solenoid's mounting post.

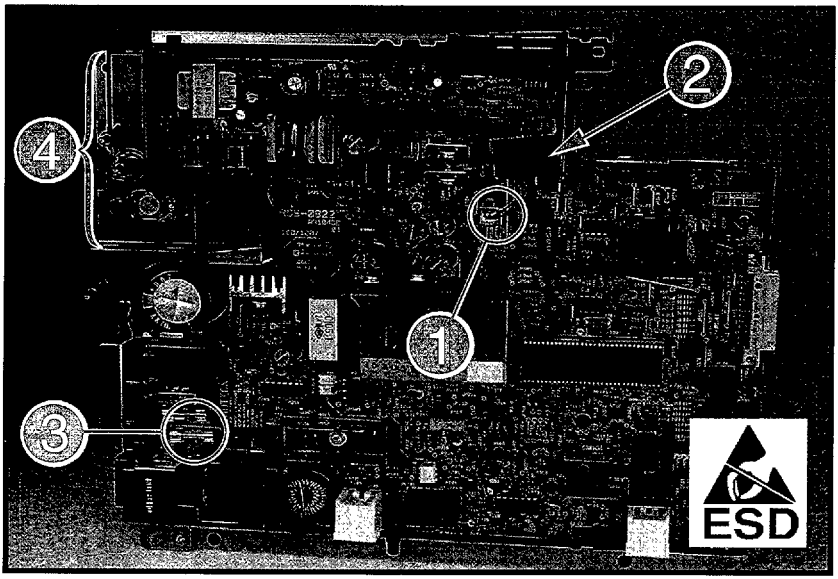

Figure 6-37 Pickup Feed Roller Solenoid (on DC Controller PCA)

To re-install:

Be sure to align the placement tabs in their proper slots before tightening the screw.

DC Controller Fuses

There are two in-line fuses (one on 220 V units) on the component side of the DC Controller PCA (shown in Figure 6-37, callout 3). (The rated amperages are printed on the PCA.) Pull outward to remove.

High Voltage Connector Assembly

This assembly is mounted on the component side of the DC Controller PCA, and provides high voltage contact points to the toner cartridge (shown in Figure 6-37, callout 4). To remove, press the two tabs in on either side of the cover and lift it straight up and off.

DC Controller PCA

If the DC Controller PCA is to be replaced, the old PCA must first be removed from its mounting assembly.

CAUTION The DC Controller PCA is ESD sensitive. Avoid using conductive tools (such as metal screwdrivers) when removing the DC Controller PCA from its mounting assembly.

1. Remove the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), and the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23).

2. Remove the DC Controller Assembly (Figure 6-36), Pickup Solenoid, and High Voltage Connector Assembly (Figure 6-37).

3. Remove the (2) machine screws (Figure 6-38, callout 1).

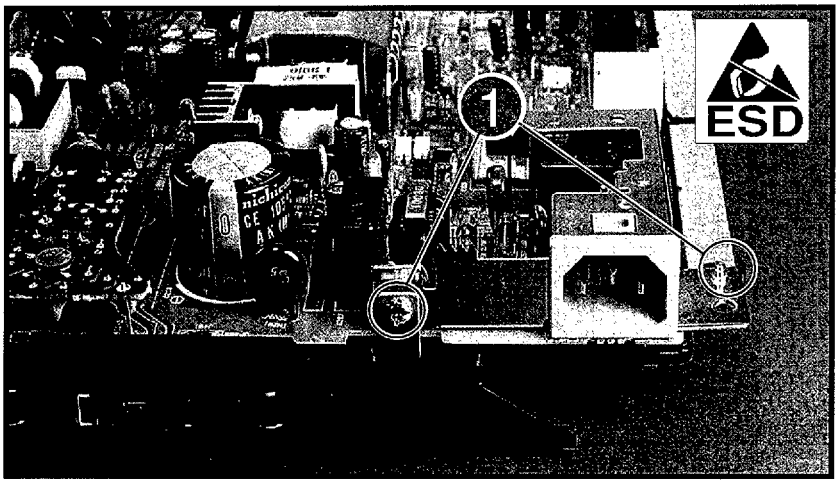

Figure 6-38 Machine Screw Locations (DC Controller PCA)

(continued on next page)

4. Remove the metal backing plate by releasing pressure on the curved portion, then tilting the plate out (Figure 6-39).

CAUTION Be careful not to lose the metal grounding clip that is attached to the mounting plate (Figure 6-40, callout 1).

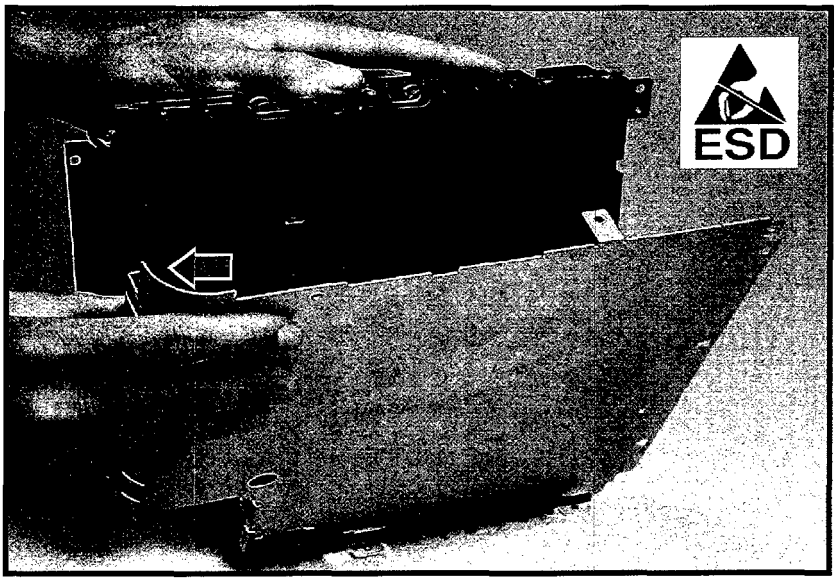

Figure 6-39 Removing the Metal Backing Plate

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5. Push the four plastic pressure tabs out to release (Figure 6-40, callout 2).

6. Squeeze the alignment pin together to release (Figure 6-40, callout 3).

7. Tilt the PCA outward at the top until it clears the lower two clips and remove the PCA (Figure 6-40, callout 4).

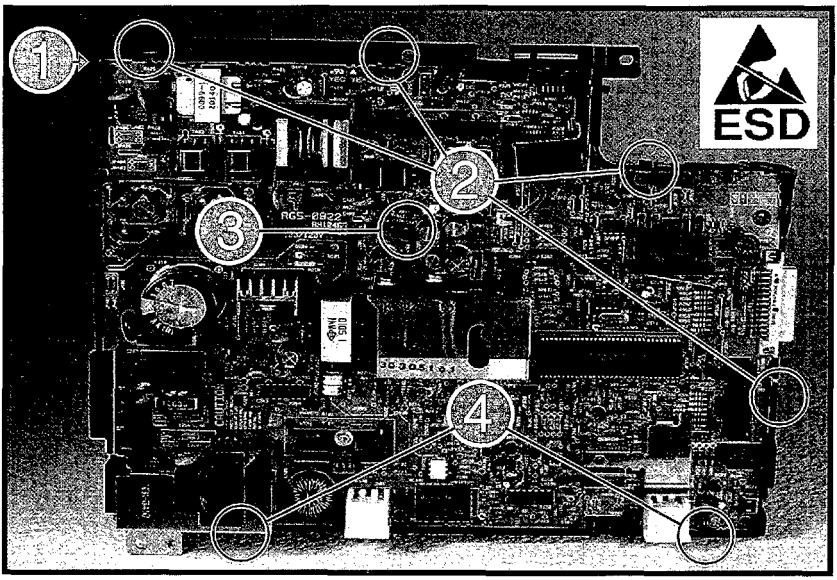


Figure 6-40 Removing the DC Controller PCA

To re-install:
After replacing the DC Controller PCA, be sure to set the leading edge registration. See "Leading Edge Adjustment" in Chapter 7.

Pickup Feed D-Roller

Access to the Pickup Feed D-Roller requires removal of the DC Controller Assembly. The D-Roller itself can be removed without removing the entire Pickup Assembly from the printer.

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), and the DC Controller Assembly (Figure 6-36).

2. Lift upward on the pressure clip (Figure 6-41, callout 1) and slide the D-Roller off the shaft.

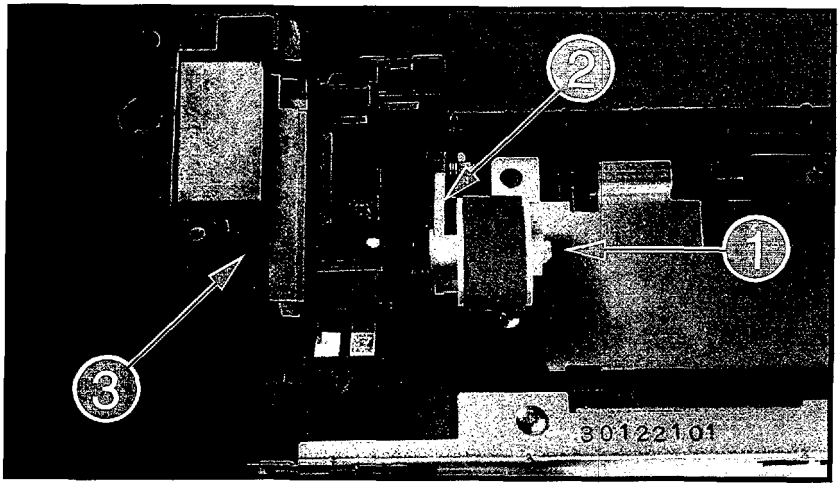


Figure 6-41 Removing the D-Roller

To re-install:

1. Position the photosensor flag arm (callout 2) out of the way.
2. Apply pressure on the opposite end of the roller shaft (callout 3).
3. Push the D-Roller onto the shaft until it "clicks" into place.
4. After replacing the D-Roller, power-on the printer without the paper cassette in place to cause the roller to rotate into the correct initial position.

Pickup Assembly

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly and Font Cartridge Bracket (*LaserJet 4P/4MP only*- Figure 6-23 and 6-16), and the DC Controller Assembly (Figure 6-36).

Note

Although not mandatory, it may be more convenient to remove the Gear Train Assembly (Figure 6-15) to provide easier access.

2. Remove the plastic latch clip (D-Roller bushing, Figure 6-42). Use needle nose pliers to twist counter clockwise and pull it out through the access opening in the Gear Train Assembly.

CAUTION

Be sure to remove the plastic latch clip as shown in Figure 6-41 before attempting to remove the D-Roller, or damage to the printer will result.

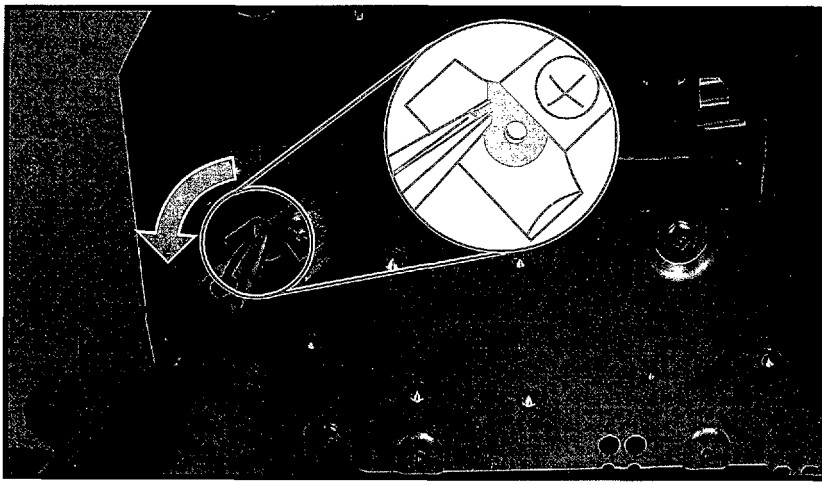


Figure 6-42 Removing the Pickup Feed Roller Assembly (side view)

(continued on next page)

3. Lift upward on the pressure clip on the end of the Pickup Feed D-Roller and remove the D-Roller (Figure 6-43, callout 1). This provides access to one of the mounting screws.

4. Remove the (2) self-tapping screws and lift the assembly straight out (Figure 6-43, callout 2).

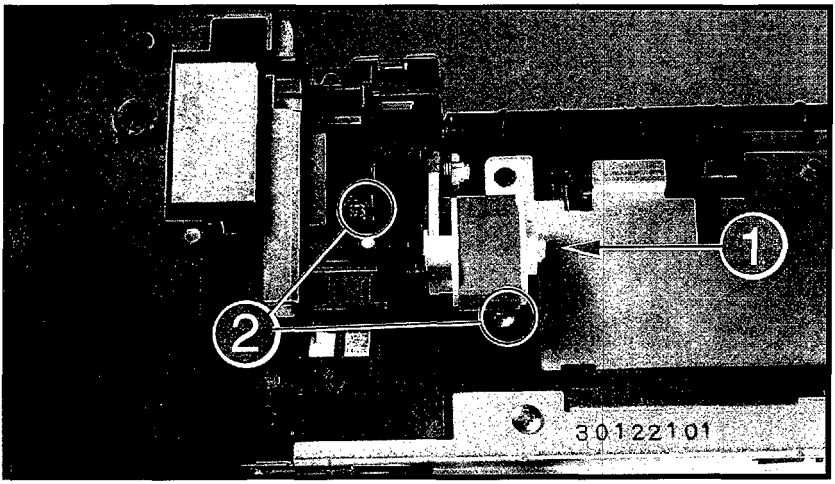


Figure 6-43 Removing the Pickup Feed Roller Assembly (bottom view)

To re-install:
Rotate the Registration Roller slightly to allow the gears to mesh before seating the assembly.

CAUTION Do NOT force the assembly back into place. Be sure the gears are meshed properly before replacing screws.

Feeder Guide Assembly and High Voltage Shield

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), and the DC Controller Assembly (Figure 6-36).
2. Remove the (2) self-tapping screws and the (1) machine screw from the Feeder Guide (Figure 6-44, callouts 1 & 2).
3. *LaserJet 4P/4MP:* Push the power switch grounding strap outward to provide clearance (Figure 6-44, callout 3).
4. Tilt the right edge (opposite the Toner Cartridge Lever) up first, then lift carefully up and toward the right to remove.

CAUTION

LaserJet 4P/4MP: Carefully free the Small Media Roller drive shaft before lifting upward to avoid damage (Figure 6-44, callout 4).

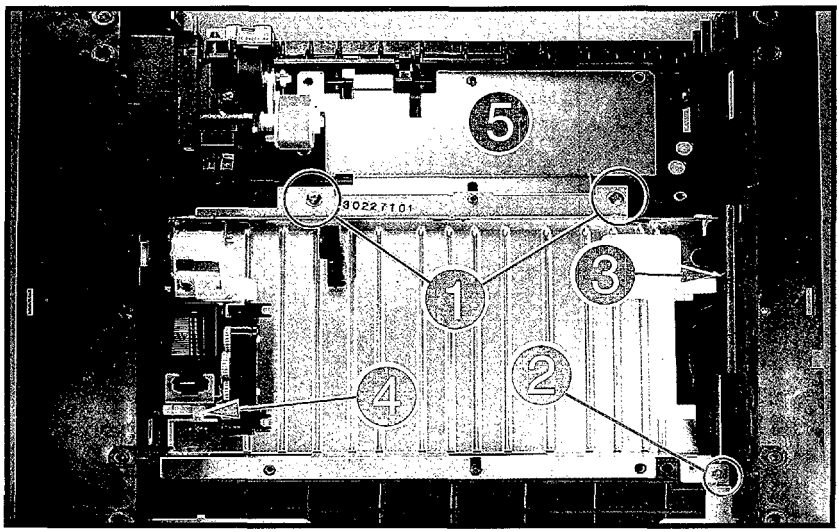


Figure 6-44 Removing the Feeder Guide Assembly (LaserJet 4P shown)

To re-install:
LaserJet 4P/4MP: Carefully align the Small Media Roller drive shaft (Figure 6-44, callout 4) before installing the Feeder Guide.

Small Media Roller Assembly (LaserJet 4P/4MP)

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), the DC Controller Assembly (Figure 6-36), and the Feeder Guide Assembly (Figure 6-44).
2. Turn the Feeder Guide black side up and remove the (1) screw from the Small Media Roller bracket (Figure 6-45, callout 1). Remove the bracket and drive shaft with the attached gear.

CAUTION The drive shaft is lubricated. Be careful not to contaminate the lubricant when handling.

3. Using a small, flat-blade screwdriver, push the (2) retaining tabs downward to release the Roller Assembly (Figure 6-45, callout 2). Slide the assembly off the Feeder Guide.

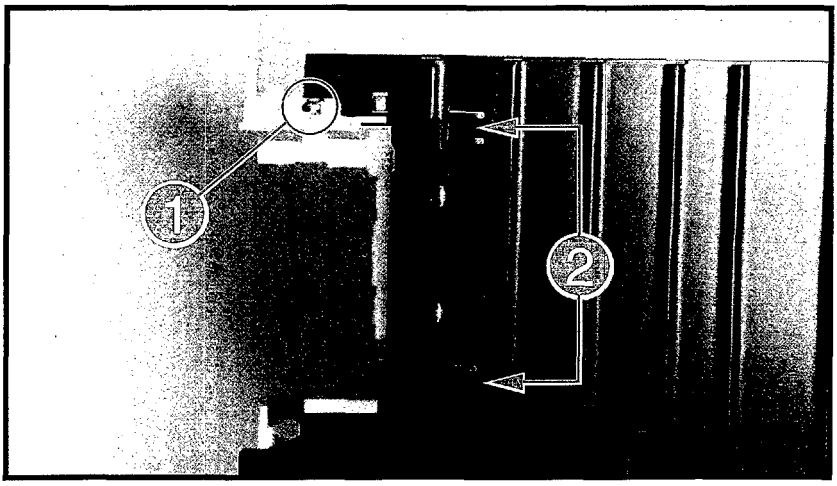


Figure 6-45 Removing the Small Media Roller Assembly

To re-install:
Carefully align the Small Media Roller drive shaft (Figure 6-44, callout 4) before sliding the Feeder Guide into place.

Static Eliminator Strip Assembly

The Static Eliminator Strip is on the under-side of the Feeder Guide Assembly.

WARNING! The metal teeth on the Static Eliminator Strip are very sharp and can cause injury.

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), the DC Controller Assembly (Figure 6-36), and the Feeder Guide Assembly (Figure 6-44).

2. Turn the Feeder Guide Assembly over, and slide the Static Eliminator Strip to the right while pushing the center tab out to release (Figure 6-46, callout 1).

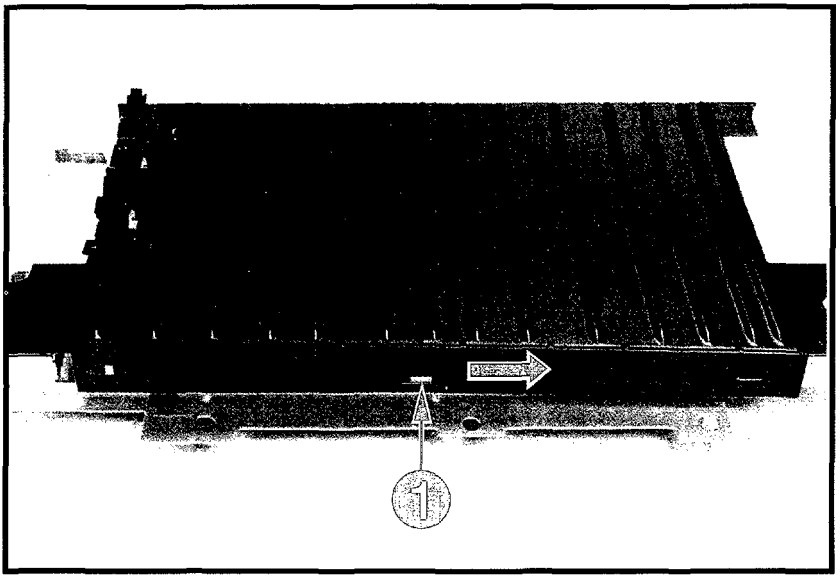


Figure 6-46 Removing the Static Eliminator Strip

Toner Cartridge Lever Assembly

The Toner Cartridge Lever Assembly is mounted on the surface of the Feeder Guide Assembly.

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), the DC Controller Assembly (Figure 6-36), and the Feeder Guide Assembly (Figure 6-44).

2. Push upward on the plastic latch which holds the axis shaft in place. Slide the axis shaft out (Figure 6-47).

3. Lift the Toner Cartridge Lever Assembly out to remove.

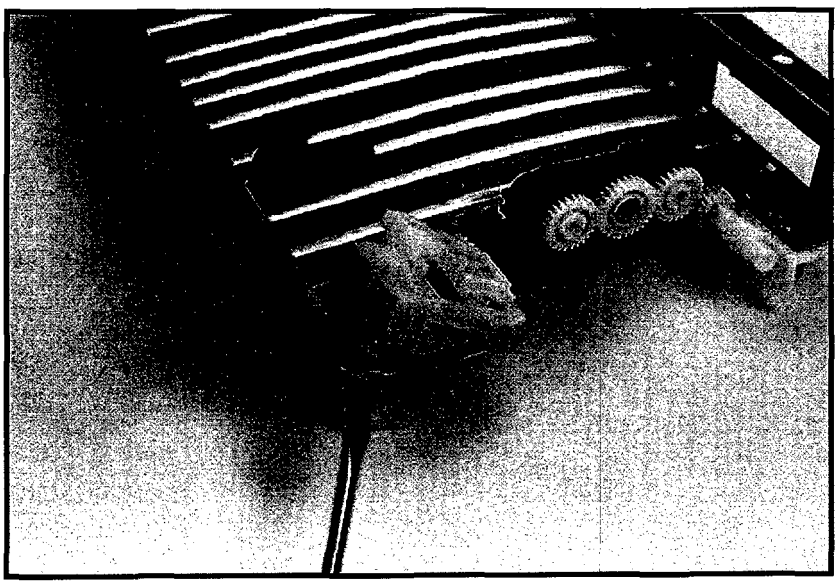


Figure 6-47 Removing the Toner Cartridge Lever Assembly

Top Door Switch (Plunger Assembly)

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), the DC Controller Assembly (Figure 6-36), and the Feeder Guide Assembly (Figure 6-44).

2. Pry outward on the tab and slide the Top Door Switch out of the printer (Figure 6-48).

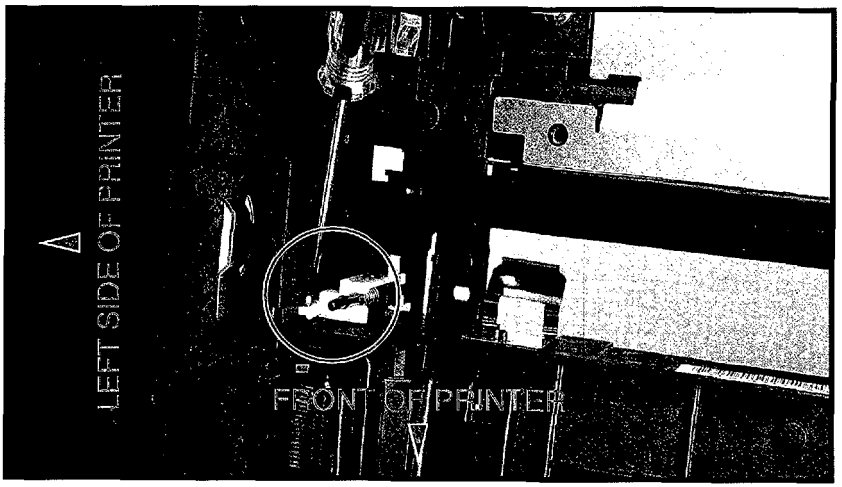


Figure 6-48 Removing the Top Cover Switch (Plunger Assembly)

DC Controller/Scanner Connector Assembly

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), and the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23).

2. Remove the Laser/Scanner Assembly (Figure 6-21), the Gear Train Assembly (Figure 6-15), the DC Controller Assembly (Figure 6-36), and the Feeder Guide Assembly (Figure 6-44).

3. From the left side of the printer, release pressure on the two tabs (Figure 6-49, callout 1).

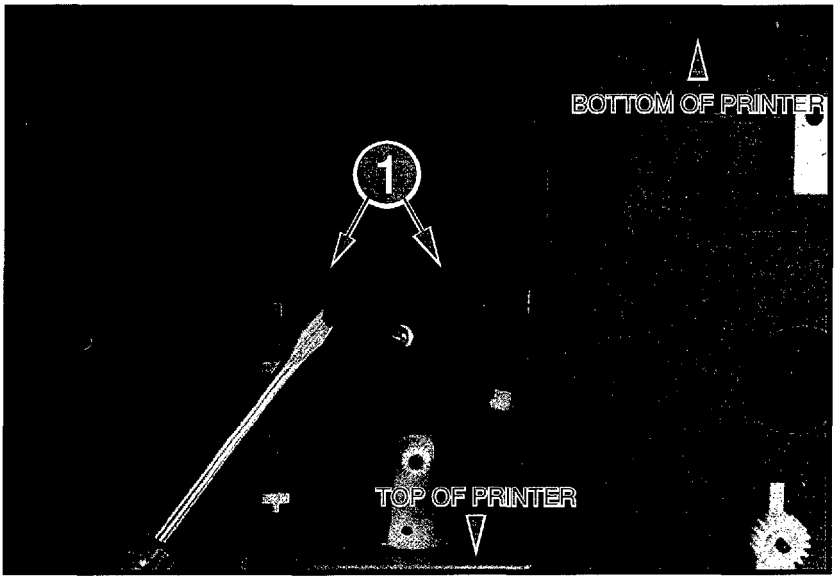


Figure 6-49 Releasing the Side Tabs (DC Controller/Scanner Connector)

(continued on next page)

4. From the top of the printer, lift the connector assembly out (Figure 6-50, callout 1).

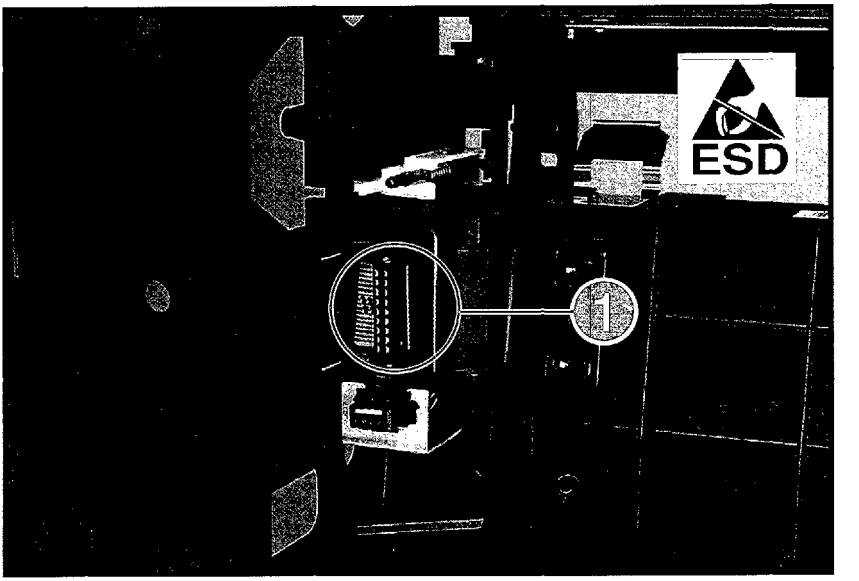


Figure 6-50 The DC Controller/Scanner Connector Location

PS1 Input Paper Sensor Arm

The PS1 Input Paper Sensor Arm is located under the Feeder Guide Assembly and High Voltage Shield.

1. Remove the Printer Cover, the Fusing Assembly (Figure 6-27), the Formatter Shield and PCA (Figure 6-13), the Power Switch Assembly (*LaserJet 4P/4MP only*- Figure 6-23), the DC Controller Assembly (Figure 6-36), and the Feeder Guide Assembly (Figure 6-44).

2. *LaserJet 4L only:* If necessary, remove the metal High Voltage Shield by lifting it out.

3. Lift the Input Paper Sensor Arm out.

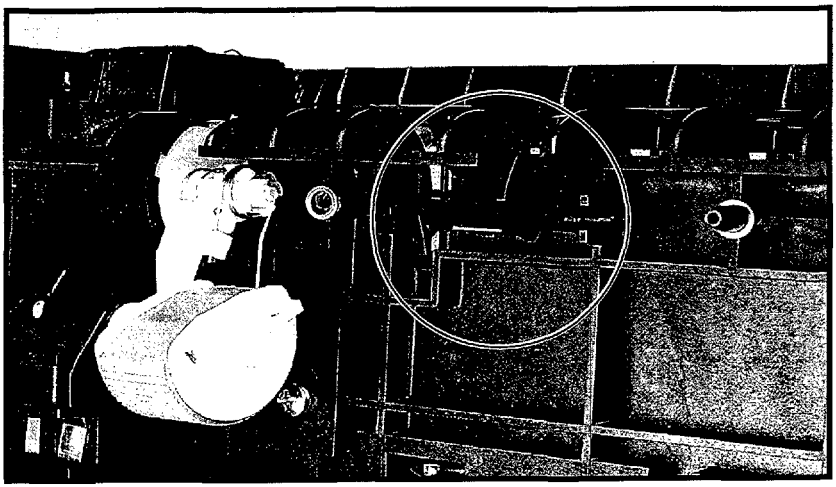


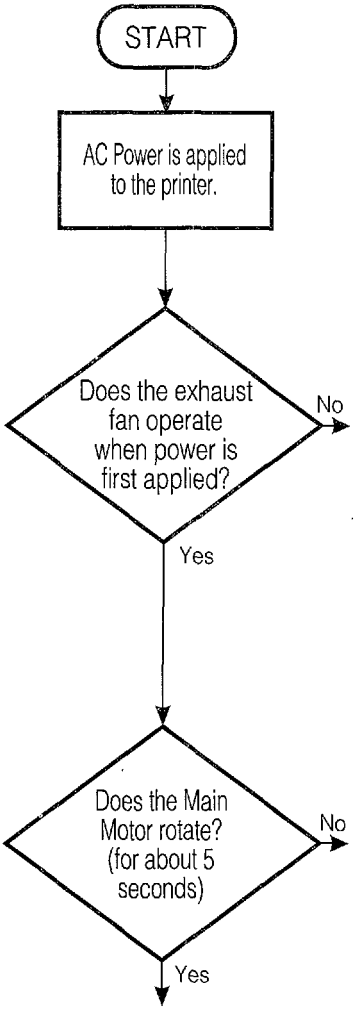
Figure 6-51 Removing the Input Paper Sensor Arm

To re-install:
Be certain the Input Paper Sensor Arm and High Voltage Shield are aligned correctly when replacing. Mis-alignment or excessive force will break the delicate sensor arm.

7

Troubleshooting

Troubleshooting Flowchart



(continued on next page)

When ac power is **first applied** to the printer:
-The exhaust fan is enabled
(4L/4ML: 35 seconds; 4P/4MP:continuous).
-The Main Motor rotates for about 5 seconds.
-Lights illuminate for about 1 second, then
4L/4ML: individually sequence front to rear.
4P/4MP: panel displays 05 SELF TEST, then 02 WARM UP, then 00 READY.

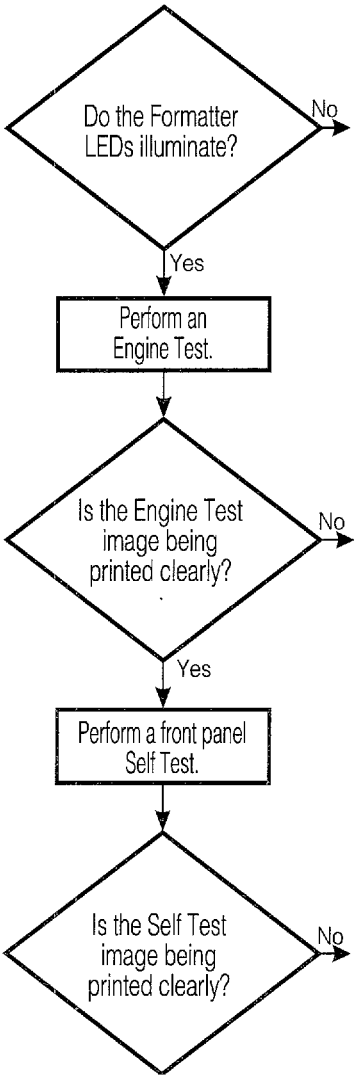
NOTE: The fan will NOT rotate if any error condition is present. Refer to Tables 7-1 through 7-15 to correct.

If no error or service message is being displayed, the Top Door is closed, and the toner cartridge is installed, yet the fan does NOT rotate when ac power is applied to the printer, verify the following:

1. Power at the receptacle is good.
2. The fan is fully seated into its connector at the Scanner Assembly.
3. The Scanner is fully seated into its connector on the DC Controller PCA.
4. Fuses FU101 and FU202 on the DC Controller are NOT open .

If no error or service message is being displayed, the Top Door is closed, and the toner cartridge is installed, yet the Main Motor does NOT rotate when ac power is applied to the printer, verify the following:

1. Motor is correctly mounted on chassis and seated into DC Controller connector.
2. Replace the Main Motor.
3. Replace the DC Controller PCA.



If the Control Panel is not functional:

1. Verify Formatter PCA is fully seated into the DC Controller PCA.
2. Replace the Formatter PCA.
3. Replace the DC Controller PCA.

Refer to the section "Image Formation Troubleshooting," later in this chapter.

If the engine test produces a clear print image, yet a clear Self Test is not generated by the front panel self test procedure, replace the Formatter PCA.

Paper Path and Components

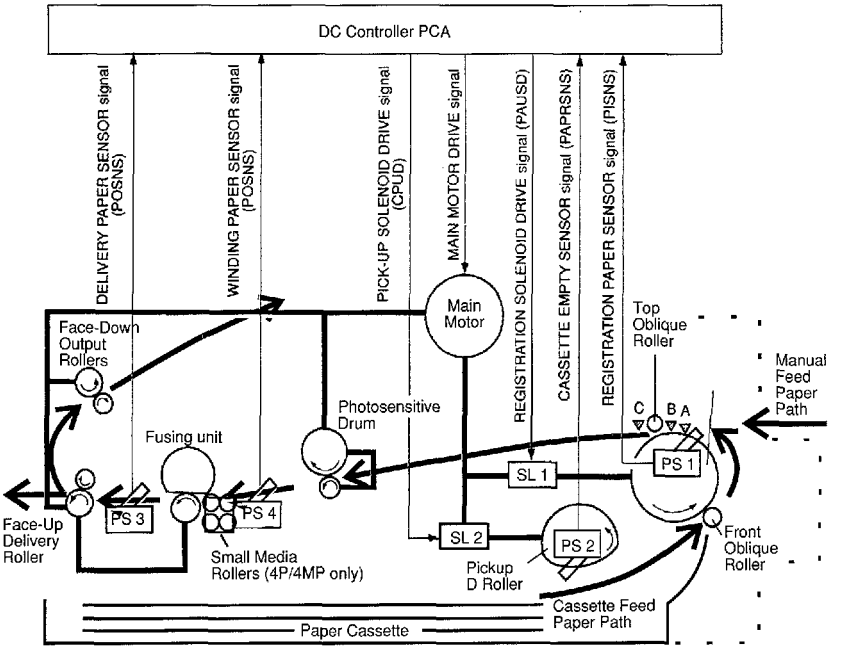


Figure 7-1 Paper Path and Components

PS1	Input Paper Sensor
PS2	Paper Out Sensor
PS3	Exit Paper Sensor
PS4	Winding Paper Sensor

Input Paper Sensor (PS1) Positions:

A = Manual Feed Sense Position

B = Registration Sense Position

C = TOP Sense Position

DC Controller Diagram

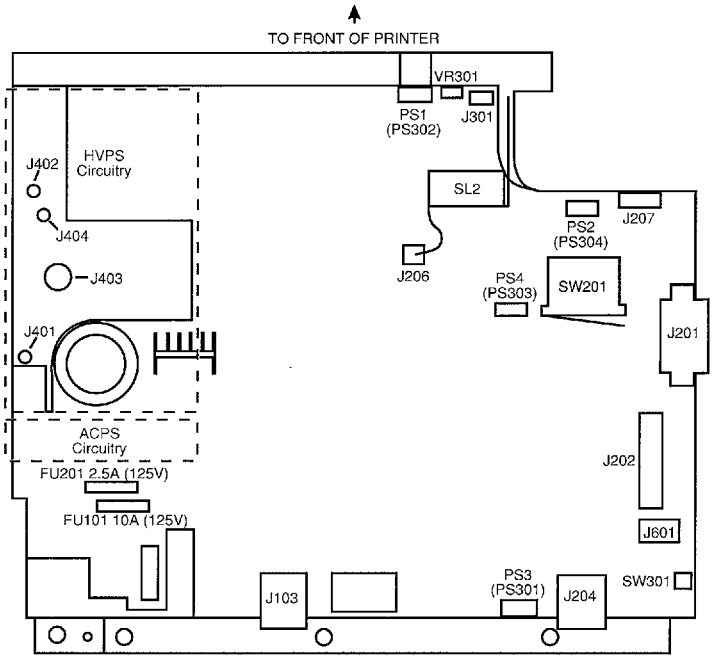


Figure 7-2 DC Controller PCA Components

J201	Formatter Connector	J404	Drum Ground
J202	Laser/Scanner Connector	VR301	Leading Edge Adjustment
J601	Main Motor Drive	SW301	Engine Test Print Microswitch
J103	Fusing Assy (Heating Element and Thermoprotector)	SW201	Top Door / Toner Cartridge Microswitch
J204	Fusing Assy (Thermistor TH1)	PS1	Input Paper Sensor
J206	Pickup Solenoid SL2	PS2	Paper Out Sensor
J207	Paper Feed Solenoid SL1	PS3	Exit Paper Sensor
J401	Primary Charge Roller	PS4	Winding Paper Sensor
J402	Developer Roller	FU201	DC Controller Power Supply Fuse
J403	Transfer Roller	FU101	Fusing System Circuitry Fuse

Printer Error Troubleshooting

The printers use various means for conveying status and error messages, as follows:

LaserJet 4L/4ML:

The HP LaserJet 4L/4ML printers are the first of the HP LaserJet family that do not use a display panel interface. Information regarding printer status is conveyed by two methods: 1) the printer's Control Panel lights, and 2) feedback through the bi-directional I/O to display on the host computer.

The basic method of determining error messages uses patterns of lights on the front panel LEDs. Printer messages are categorized into two basic types: **Recoverable Errors,** and **Service Errors.** Both types are covered in the following sections.

Note Before troubleshooting a Service Error, cycle the power to the printer to see if the error persists.

LaserJet 4P/4MP:

The LaserJet 4P/4MP uses an alphanumeric display panel for conveying status and error messages. In addition, as in the LaserJet 4L, feedback is directed through the printers bi-directional I/O to display on the host computer.

Priority of Errors

Each error has a priority in relation to the others. If there is more than one error condition at the same time, the highest priority error will be displayed. The priority of errors is:

1. Service Errors
2. Door Open/No Toner Cartridge
3. Paper Jam
4. Paper Out
5. Memory Error
6. Manual Feed

Recoverable Errors

Recoverable Errors are displayed on single front panel lights without pressing the front panel button. Recoverable errors do not require a service call unless the error persists after the suggested remedy has been implemented. Recoverable errors are listed in Tables 7-1 through 7-5.

Table 7-1 Paper Out Error

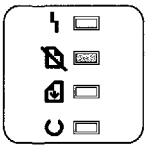
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Paper light is **on steady**. All other lights are off.	PC LOAD [paper size]	1. Paper Cassette is empty or missing. 2. Add paper and/or insert cassette. 3. Reseat the cassette. 4. Check if Paper Out flag PS2 (bottom of printer, adjacent to the Pickup D-Roller) is broken or movement is hindered. Unstick or replace the Pickup Assembly. 5. Replace DC Controller PCA.

Table 7-2 Paper Jam Error

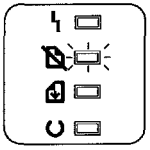
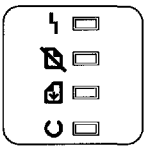
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Paper light is **blinking**. All other lights are off.	13 PAPER JAM	1. Paper in printer. Remove paper by referring to Chapter 4, Clearing Paper Jams. 2. Rear Door Open. Close door and reset printer. 3. Jam removed but printer not reset. Perform front panel reset. 4. Transfer Roller Guide Plate not installed correctly (all 3 tabs must be in position). See Chapter 6 for installation procedure. 5. Stuck or broken flags/sensors. Note where the leading edge of the paper is to determine which paper sensor may be causing the jam. Ensure sensor flags rotate freely. Replace flags or associated assemblies if broken or if they remain stuck. 6. Paper fragment under oblique rollers (top or front). Remove rollers and clear out paper. 7. Main Motor faulty. Power up the printer and observe if the stacker rollers rotate. If not, replace the Motor. 8. Stuck or Faulty Gears in Gear Train. Replace Gear Train. 9. Toner cartridge not rotating. Refer to "Drum Rotation Functional Check" later in this chapter. 10. Transfer Roller Gear missing or broken. Replace the Transfer Roller. 11. Stuck or broken solenoids. Replace solenoid or associated assembly. 12. DC Controller PCA faulty. Replace PCA. 13. Software related: for example, program in letter, but feeding legal size paper. Change the software paper size setting, or feed the designated size.

Table 7-3 Door Open Error

LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Error light is **on steady**. All other lights are off.	12 OPEN OR NO EP	1. Printer's Top Door is open and/or the toner cartridge is missing or not installed properly. Reinstall toner cartridge and close door. 2. Part of the Top Door that pushes the plunger down is broken. Replace the Top Door. 3. Top Door Switch (Plunger Assembly) is broken. Replace (see Figure 7-3). 4. Toner Cartridge Lever Assembly is broken. Replace the Assembly. 5. Faulty Microswitch SW201 (Top Door Switch) on the DC Controller PCA. Replace DC Controller PCA.

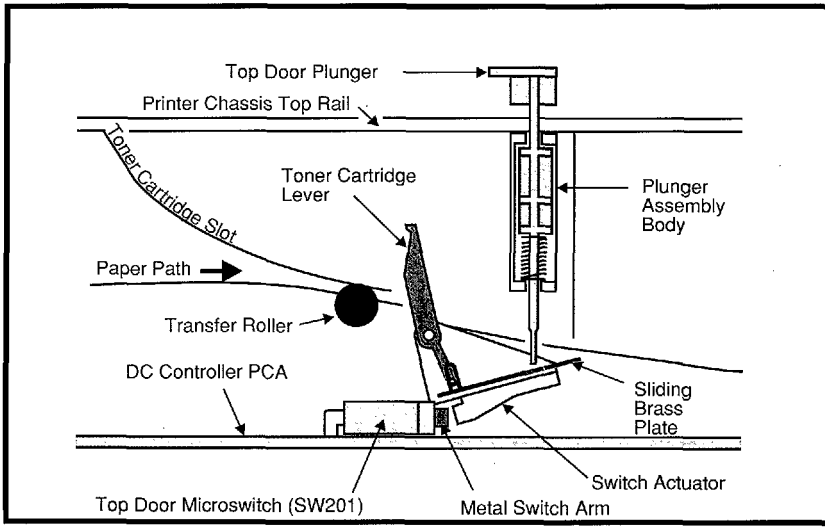


Figure 7-3 Top Door/Toner Cartridge Plunger and Lever Assembly

Table 7-4 Memory Error

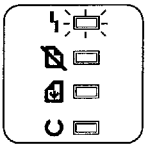
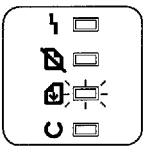
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Error light is **blinking**, and all other lights are off.	20 MEM OVERFLOW 21 PRINT OVERRUN 22 ERROR	1. Too much data, or data too complex. Turn Page Protection ON or to AUTO (can be set within HP Explorer's Remote Control Panel). 2. Add optional memory. 3. Reduce the complexity of the print job. LaserJet 4P/4MP: Press **Continue** to resume printing.

Table 7-5 Manual Feed

LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Data light is **blinking**, and all other lights are off.	MF FEED [paper size] ME FEED[env. size]	1. Insert paper into the manual feed slot. This will fulfill the manual feed request. 2. To avoid manual feed on this job, press the front panel button to override the manual feed request and to feed paper from the paper cassette. 3. To avoid manual feed on future jobs, go into a software application or the HP LaserJet Explorer to change the setting from Manual Feed to Paper Cassette feed.

Service Errors

Service Errors inhibit further operation of the printer until some action is taken.

LaserJet 4L/4ML

All lights will turn on in a steady state. Pressing and holding the front panel button will reveal a pattern on the lights. (The error pattern will only be displayed as long as the front panel button is held down.) Use this pattern and the corresponding reference in Tables 7-6 through 7-15 to identify what type of service error has occurred.

LaserJet 4P/4MP

Service messages are displayed on the front Control Panel in the same manner as all other messages. No action is required to display further error codes.

Table 7-6 Service Error

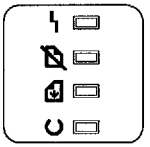
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 All four lights on (without pressing the front panel button).	Not Applicable (LaserJet 4L/4ML Only)	There is a service error. **Press and hold the front panel button** to display the error light code. This code will be shown only while the button is pressed. The following tables list possible error codes. NOTE: If no further error code is displayed, yet all four lights remain on continuously, power cycle the printer. If the condition persists, replace the Formatter PCA.

Table 7-7 Fuser Error

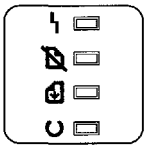
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Ready and Error lights are on and all others are off.	50 SERVICE	1. Remove power to the printer for 15 minutes. If this doesn't clear the error: 2. Perform the Fuser Checks shown in the table below. 3. Check the Fuses (FU101 and FU201) on the DC Controller PCA. Replace if faulty. 3. Replace the DC Controller PCA.

Table 7-8 Fuser Checks

SUSPECT	CHECK
1. Connector Contact	Ensure that J103 and J204 connectors on the Fusing Assembly are seated securely into the DC Controller PCA connectors (see Figure 6-29 in Chapter 6 for locations). Reseat the Fusing Assembly.
2. Thermistor wire open.	Remove the Fuser and measure the resistance between connectors J204-1 and J204-2 (see Figure 6-29 in Chapter 6 for location). Resistance should read approximately 440 K Ohms at 20 Deg C (room temperature). If the thermistor wire is open, replace the Fusing Assembly.
3. Thermal Fuse.	Measure the continuity between connectors J103-1 and J103-2 on the Fuser (see Figure 6-29, Chapter 6 for location). It should be approximately 29 Ohms. If the thermal fuse is open, replace the Fusing Assembly.

Table 7-9 Beam Error

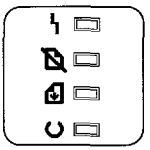
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Data and Error lights are on and all others are off.	51 ERROR	Power-cycle the printer. If this doesn't clear the error: 1. Reseat the Laser/Scanner Assembly into the Scanner/DC Cable Assembly. 2. Replace the Laser/Scanner Assembly. 3. Replace the DC Controller PCA. 4. Replace the Scanner/DC Cable Assembly.

Table 7-10 Scanner Error

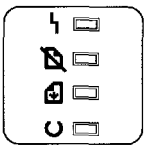
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Paper and Error lights are on and all others are off.	52 ERROR	Power-cycle the printer. If this doesn't clear the error: 1. Ensure condensation from moving the printer from a cold to warm environment hasn't occurred. Allow the printer 6 hours to acclimate to the warm room. 2. Reseat the Scanning Assembly. 3. Replace the Laser/Scanner Assembly. 4. Replace the DC Controller PCA. 5. Replace the Scanner/DC Cable Assembly.

Table 7-11 RAM/ROM Error

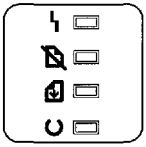
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Data light is on and all others are off	53 [XY-ZZ] ERROR	An error has been found in RAM or ROM. 1. Power-cycle the printer. If this doesn't clear the error: 2. Power off the printer, remove any additional memory, then power back on. If the message clears, replace the memory card. 3. Replace the Formatter PCA. **LaserJet 4P/4MP:** Use the list below to decode the [XY-ZZ] values: X - Hardware type: 0 = ROM 1 = RAM Y - Hardware device: 0 = On board RAM/ROM. 1 = SIMM slot one. 2 = SIMM slot two. 3 = SIMM slot three. ZZ - Error Number: 00 = Unsupported memory. 01 = Unrecognized memory. 02 = Unsupported memory size. 03 = Failed RAM test. 04 = Exceeded max RAM size. 05 = Exceeded max ROM size. 06 = Invalid SIMM speed. 07 = SIMM reporting incorrect. 08 = SIMM RAM parity error.

Table 7-12 Engine Error

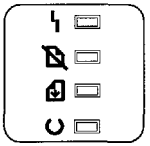
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Error light is on; all others are off.	55 ERROR	The Formatter and DC Controller are not communicating. Power-cycle the printer. If this doesn't clear the message: 1. Reseat the Formatter PCA into the DC Controller connector. 2. Replace the Formatter PCA. 3. Replace the DC Controller PCA. 4. Replace the DC Controller connector.

Table 7-13 Main Motor Error

LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
(See Table 7-2, Paper Jam)	57 ERROR	The DC Controller has reported a general motor failure. The Main Motor is controlled by the DC Controller PCA, and seated into connector J601. Power-cycle the printer. If this doesn't clear the message: 1. Reseat the Main Motor into the DC Controller connector. 2. Inspect the Gear Train for debris that would block the free operation of the gears. 3. The toner cartridge may not be rotating. Refer to "Drum Rotation Functional Check" later in this chapter. 4. Main Motor faulty. Power-up the printer and observe if stacker rollers rotate. If not, replace the Main Motor. 5. Replace the DC Controller PCA.

Table 7-14 Fan Error

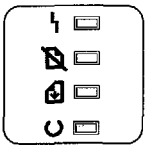
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Ready, Data and Error lights are on and all others are off.	58 SERVICE	1. Power-cycle the printer. 2. Check the fan to determine if it is blocked from operation. 3. Reseat the fan connector on the Laser/Scanner Assembly. 4. Replace the Fan. 5. Replace the Laser/Scanner Assembly. 6. Replace the DC Controller. 7. Replace the connector between the Scanner and DC Controller.

Table 7-15 Formatter Error

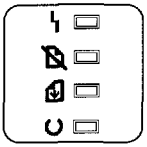
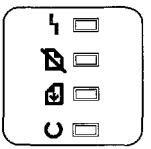
LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 Error light is off; the other lights display some pattern (not otherwise shown in this table).	61 - 67 SERVICE 70 - 71 ERROR 72 - 79 SERVICE	1. Power-cycle the printer. 2. Replace the Formatter PCA.

Table 7-16 NVRAM Error

LaserJet 4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
(See Table 7-11, RAM Error)	68 ERROR 68 SERVICE	**68 ERROR** indicates a recoverable error in NVRAM. Press Continue to clear, then check control panel settings. One or more fields will have been reset to factory defaults during recovery. **68 SERVICE** indicates NVRAM is full. 1. Perform NVRAM Reset to clear NVRAM (hold down **Item** key during power-on). 2. Replace the Formatter PCA.

Table 7-17 Blank Display

LaserJet 4L/4ML LEDs	LaserJet 4P/4MP Display Panel	Description & Recommendations
 All lights off (blank display).	[blank]	If the printer's lights remain off (LaserJet 4L/4ML) or the message display panel remains blank (LaserJet 4P/4MP), check the following: 1. (4L/4ML): Printer is in Intelligent Off mode. Press the front panel button, or open the Top Door. 2. Power is not supplied to the printer. Check power cord connections and power source. 3. Print an engine test print to determine if the print engine is functional. If the test is successful, replace the Formatter PCA. 4. Check Fuses FU101 and FU201 on the DC Controller PCA. Replace if necessary. 5. Replace the DC Controller PCA. 6. Replace the connector between the DC Controller and the Formatter.

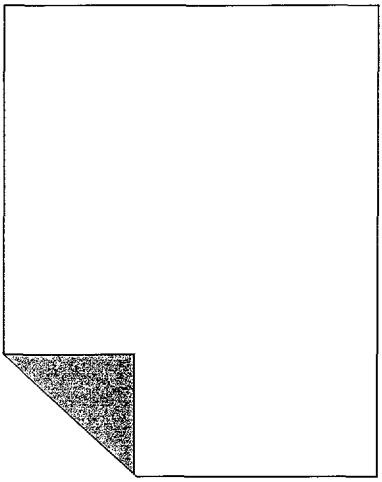
Clearable Warnings (LaserJet 4P/4MP)

A clearable warning indicates a transient condition in the printer. The printer continues on line while the message is displayed, in place of 00 READY. A clearable warning appears each time the printer alters resolution or page protection (this causes reconfiguration of memory), or aborts a job due to an invalid or uninstalled personality, or insufficient memory.

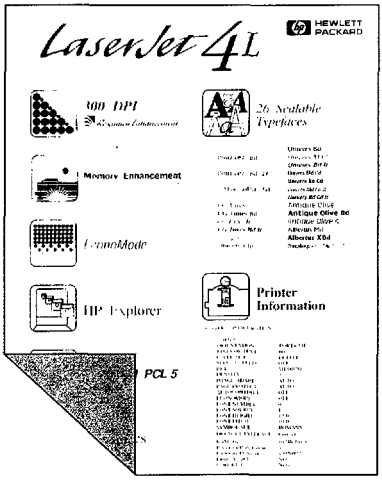
Message Displayed	Meaning
W1 IMAGE ASSIST	The printer received a graphics print file that was too complex to print at the requested resolution. The printer automatically processed the file in the highest resolution possible with the memory installed. Add additional memory to print the file at full resolution. Check the printout for loss of data or print quality.
W2 INVALID PERS	The job was not printed because the requested personality, such as PostScript, was not installed. Install the language in which the files are sent, together with enough memory to support that language.
W3 JOB ABORTED	The printer was forced to abort the print job because there was not enough installed memory to support the printer language used.
W4 JOB 300/OFF	The job was printed at 300 dpi with page protection off. To print the job as requested, install additional memory.
W5 JOB 300/LTR	The job was printed at 300 dpi with page protection set to letter. To print the job as requested, install additional memory.
W6 JOB 300/A4	The job was printed at 300 dpi with page protection set to A4. To print the job as requested, install additional memory.
W7 JOB 300/LGL	The job was printed at 300 dpi with page protection set to legal. To print the job as requested, install additional memory.
W8 JOB 600/OFF	The job was printed at 600 dpi with page protection off. To print the job as requested, install additional memory.
W9 JOB 600/LTR	The job was printed at 600 dpi with page protection set to letter. To print the job as requested, install additional memory.
W0 JOB 600/A4	The job was printed at 600 dpi with page protection set to A4. To print the job as requested, install additional memory.

Image Formation Troubleshooting

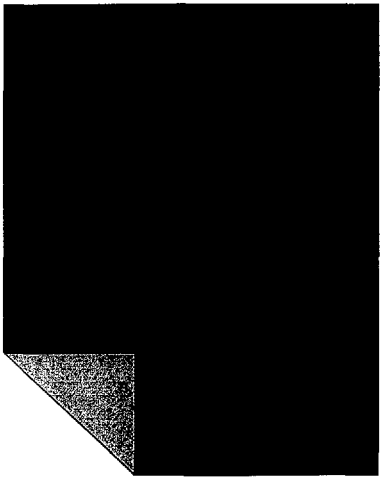
This section illustrates some image defects and their possible causes. Since there are many variables in the printing process, it is possible to encounter image defects that are not illustrated below. If you find a defect that is not illustrated, record the probable cause along with the printing environmental conditions and save a copy of the defect for future reference.



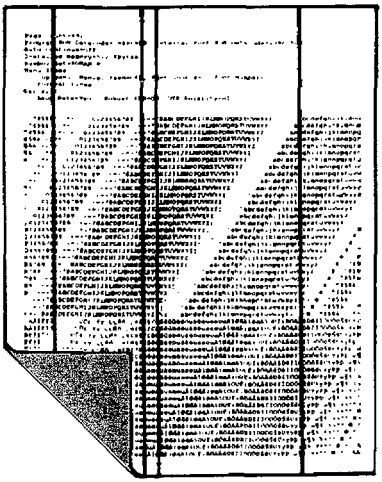
BLANK PAGE
(See Table 7-18)



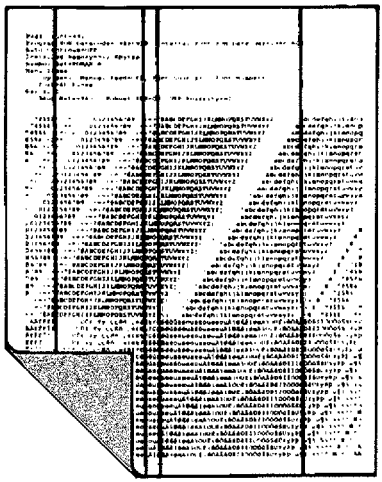
FADED PRINT
(See Table 7-20)



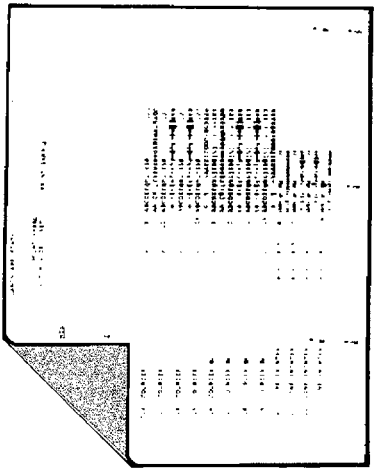
BLACK PAGE
(See Table 7-19)



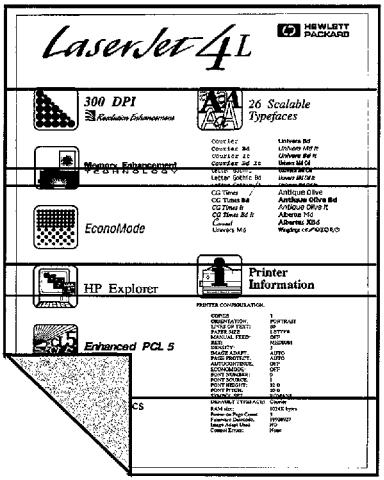
VERTICAL WHITE STRIPES
(See Table 7-21)



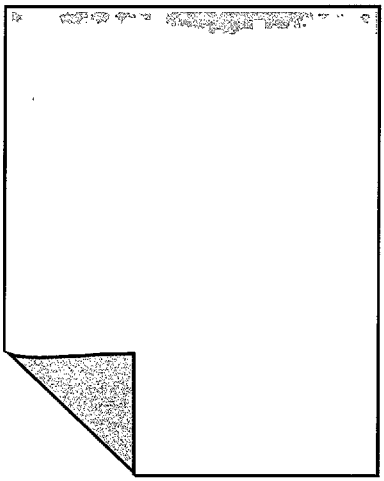
VERTICAL BLACK LINES
(See Table 7-22)



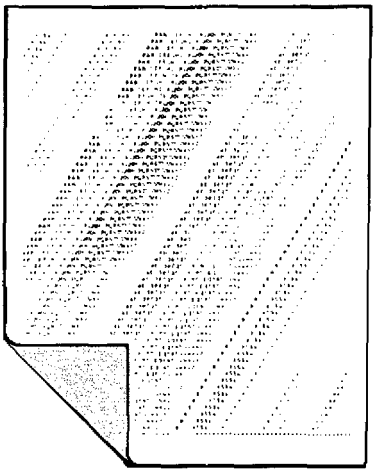
REPETITIVE DEFECTS
(See Table 7-24)



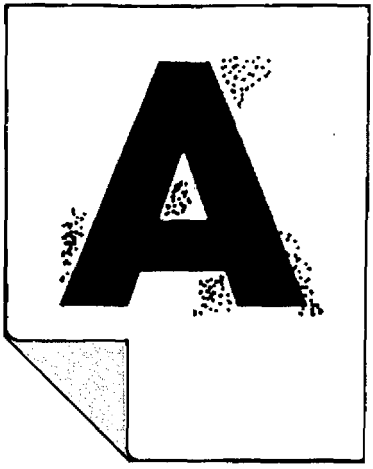
HORIZONTAL BLACK LINES
(See Table 7-23)



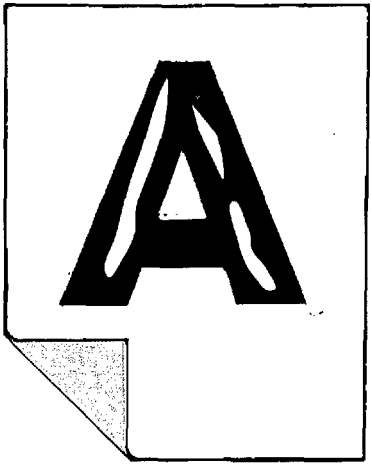
STAINING
(See Table 7-25)



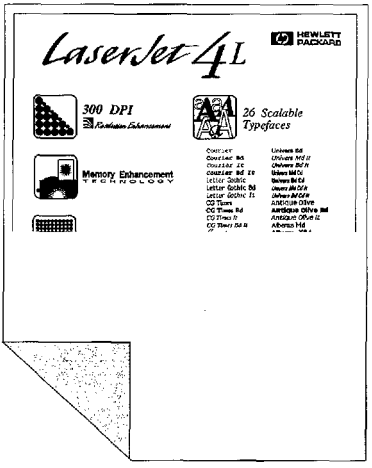
DROPOUT
(See Table 7-26)



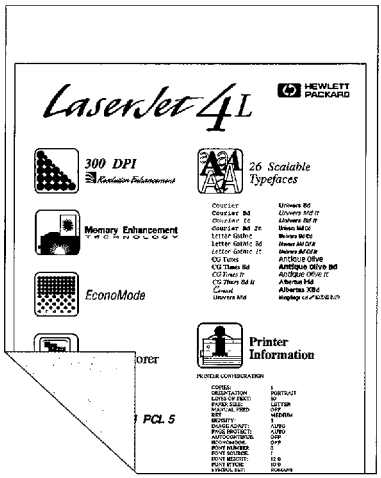
BACKGROUND SCATTER
(See Table 7-28)



CHARACTER VOIDS
(See Table 7-27)



BOTTOM PORTION BLANK
(See Table 7-29)



FAULTY REGISTRATION
(See Table 7-30)

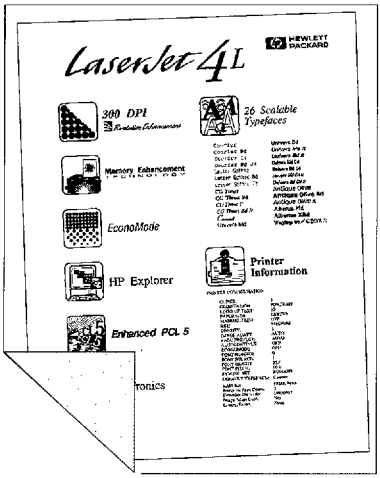
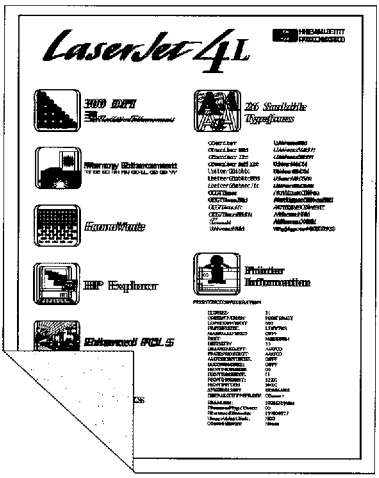
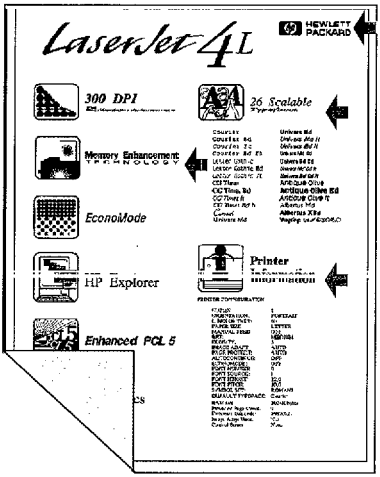


IMAGE SKEW
(See Table 7-32)



SMEARED PRINT
(See Table 7-31)



COMPRESSED PRINT
(See Table 7-33)

Table 7-18 Blank (White) Page

POSSIBLE CAUSE	RECOMMENDED ACTION
OCCASIONAL BLANK PAGES:	
1. Software Configuration.	Make sure the application software is not sending incorrect page length requests, or extra page eject commands.
2. Network Configuration. Some sharing devices on networks may generate a blank page as a separator.	Check with the Network Administrator.
3. Multiple Feeds. The printer may be feeding two or more pages at once because the paper is difficult to separate.	Remove the paper from the paper cassette and fan the edges of the paper to separate the pages. Refer to "Media Specifications" in Chapter 2 to ensure paper meets recommendations.
ALL PAGES BLANK:	
1. Sealing tape left in toner cartridge.	Remove the sealing tape.
2. Empty or defective toner cartridge.	If unsure, weigh the cartridge: Full weight = 852 grams (30.1 oz) Empty weight = 730 grams (25.8 oz) Perform the "Drum Rotation Functional Check" described later in this chapter or try a known good toner cartridge. Replace the toner cartridge if necessary.
3. Defective or contaminated Transfer Roller. Without a functional Transfer Roller, toner cannot be pulled from the photosensitive drum to the paper.	Check roller installation and contact. Perform the "Half Self Test Functional Check" described later in this chapter. If there is an image on the drum, but not on paper, replace the Transfer Roller.
4. Laser/Scanner door not opening properly.	1. Remove and re-seat the toner cartridge. 2. Check the Laser/Scanner shutter door for proper operation. If defective, replace the Laser/Scanner Assembly.

(continued on next page)

ALL PAGES BLANK (continued) 5. High Voltage Connector Assembly is defective. The High Voltage Connector Assembly mounts on the DC Controller PCA and uses spring-loaded pins to contact the toner cartridge.	Check the pins and springs for functionality. Clean if dirty, replace is defective or missing.
6. DC Controller PCA is defective. The DC Controller supplies the proper voltage to the High Voltage contacts.	Replace the DC Controller PCA.

Table 7-19 Black Page

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Defective toner cartridge.	Replace the toner cartridge.
2. Light is leaking into the printer.	Ensure all covers are in place.
3. High Voltage Connector Assembly is defective. The High Voltage Connector Assembly mounts on the DC Controller PCA and uses spring-loaded pins to contact the toner cartridge.	Inspect and clean the contacts on the High Voltage Connector Assembly. Closely inspect the primary roller contacts (see Figure 7-2). If damaged, replace the High Voltage Connector Assembly.
4. High voltage power supply circuit is defective (not supplying the correct negative voltage).	Replace the DC Controller PCA.
5. DC Controller PCA is defective. If the DC Controller turns ON the laser beam continuously, the entire surface of the Photosensitive drum is neutralized causing a completely black page.	Replace the DC Controller PCA.
7. Laser/Scanner Assembly faulty (turning laser on continuously).	Replace the Laser/Scanner Assembly.
8. Connector between the Laser/Scanner Assembly and DC Controller is defective.	Replace the Scanner/DC Controller connector.

Table 7-20 Faded Print

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Toner supply low.	Shake the cartridge gently to redistribute the toner, or replace the cartridge.
2. Print Density is set incorrectly. Print Density is adjustable through software, through HP Explorer's Remote Control Panel, or through the front control panel (LaserJet 4P/4MP).	Change to a darker setting and retry printing.
3. EconoMode is on. EconoMode saves toner by reducing the dot density. This may appear to be a print quality problem in some cases.	Turn EconoMode off through software, through HP Explorer's Remote Control Panel, or through the front control panel (LaserJet 4P/4MP).
4. Paper does not meet specs. The moisture content, conductivity, or surface finish may not work correctly with the printer's electrophotographic process.	Try a different paper lot (see "Media Specifications" in Chapter 2).
5. Transfer Roller is defective or incorrectly installed. If the transfer roller loses conductivity, it cannot effectively pull toner from the drum to the paper.	Inspect the Transfer Roller for proper installation and contact. If the Transfer Roller is damaged, replace it.
6. Laser/Scanner door not opening properly.	1. Remove and re-seat the toner cartridge. 2. Check the Laser/Scanner shutter door for proper operation. If defective, replace the Laser/Scanner Assembly.
7. High Voltage Connector Assembly is defective. The High Voltage Connector Assembly mounts on the DC Controller PCA and uses spring-loaded pins to contact the toner cartridge.	Check the pins and springs for functionality. If dirty, clean using alcohol; if damaged, replace the High Voltage Connector Assembly.
8. DC Controller PCA is defective. The DC Controller supplies the proper voltage to the High Voltage contacts.	Replace the DC Controller PCA.

Table 7-21 Vertical White Stripes

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Toner cartridge is nearly empty. This can cause uneven toner distribution.	Remove the toner cartridge and shake it gently. The cartridge will soon require replacement.
2. Toner cartridge has been exposed to too much light.	Store the toner cartridge in a darkened environment for several days. This may restore the photosensitive potential.
3. Contaminated Beam-to-Drum Mirror. A dirty mirror will reduce the amount of light that reaches the toner cartridge's photosensitive drum. NOTE: An excessively dusty environment can allow dust particles to be drawn into the printer, contaminating the Beam-to-Drum Mirror.	Inspect the mirror. Use filtered, compressed air to clean. If still dirty, clean it carefully using lens cleaner and a lint free cloth or swab. NOTE: If removing the mirror, note its alignment position relative to the mark on the printer chassis before loosening the screw on the right end. If the mirror needs adjustment, refer to the procedure under "Beam-to-Drum Mirror Adjustment" later in this chapter.
4. Foreign objects in beam path. Any foreign objects will block the light from developing an image on the Photosensitive drum.	Remove the toner cartridge and check the laser beam printer slot for foreign objects. Replace the toner cartridge if it is damaged. Remove the Printer Cover and inspect the path from the Laser/Scanner to the mirror, looking for foreign objects in the beam path. Replace the Laser/Scanner Assembly if the lens is scratched.

Table 7-22 Vertical Black Lines

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Toner cartridge is damaged.	Inspect the toner cartridge for a scratched photosensitive drum or toner leaking through worn seals. Replace as necessary.
2. Fusing Assembly is contaminated or damaged.	Inspect the Fusing Assembly for toner build-up or scratches on the fuser rollers Try cleaning with alcohol. Replace the Fusing Assembly if damaged.
3. Static Eliminator Strip teeth are contaminated or defective.	Remove and inspect (see Chapter 6 for removal procedure). Clean using compressed air. Replace if damaged.

Table 7-23 Horizontal Black Lines

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Toner cartridge not seated properly.	Remove the cartridge and reinsert it.
2. Toner cartridge defective.	Replace the cartridge.
3. Repetitive defect. If the lines are repeated at a consistent interval down the page, this is a repetitive defect.	Refer to Table 7-24 (next), as well as the "Repetitive Image Defect Ruler," (Figure 7-9).

Table 7-24 Repetitive Defects

When troubleshooting repetitive image defects, use the Repetitive Image Defect Ruler, supplied in Figure 7-9 to measure the distance between recurring defects.

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Toner cartridge is damaged.	The circumference of the photoconductive drum inside the toner cartridge is 75 mm (2.95 inches). If the defect repeats at this interval, the defect is associated with the drum. Inspect the drum for scratches or damage. Replace the toner cartridge.
2. Dirty Rollers. Any dirty roller in the paper path may result in a repetitive print defect.	Examine and clean rollers in the paper path (refer to "Cleaning Printer Components" in Chapter 4).
3. Fusing Assembly is dirty or defective.	The circumference of the lower fusing Pressure Roller is 47 mm (1.85 inches). If the defect repeats at this interval, the defect is associated with the Pressure Roller. Clean the Fusing Assembly using alcohol. If the problem persists, replace the Fusing Assembly.
4. Gears are worn, causing slippage or jumping.	Inspect the gears driving the toner cartridge and the Fuser. Replace the Gear Train Assembly if necessary.
5. Paper does not meet specs. The surface of the paper may be too coarse, causing repeated marks.	Try a different paper lot (see "Media Specifications" in Chapter 2).

Table 7-25 Staining

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Printing on wrong side of paper. The label on the ream of paper indicates which side to print on. The different surface properties of some papers may cause problems if loaded wrong side up.	Check for the arrow on the paper wrapper. Be sure paper is loaded with the **arrow pointing down** in the paper cassette.
2. Dirty printer.	Clean the inside of the printer as described in Chapter 4.
3. Dirty Transfer Roller. This problem is characterized by staining on the back of the paper and will not occur unless the Transfer Roller is extremely dirty.	Clean the Transfer Roller using a dry, lint-free cloth.
4. Toner build-up in the Fusing Assembly. Toner build-up can physically damage the Fusing Assembly.	Remove and clean the Fusing Assembly (see Chapter 6).
5. Toner build-up caused by duplexing.	Either avoid duplexing or clean the printer more often.
6. Leaking toner cartridge.	Replace the toner cartridge.
7. Paper does not meet specs. The paper moisture content, conductivity, or surface finish may not work correctly with the printer's electrophotographic process.	Try a different paper lot (see "Media Specifications" in Chapter 2).

Table 7-26 Dropout

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Single sheet of paper defective.	Try reprinting the job.
2. Paper does not meet specs. The paper moisture content, conductivity, or surface finish may not work correctly with the printer's electrophotographic process.	Try a different paper lot (see "Media Specifications" in Chapter 2).
3. High voltage power supply defective (low primary voltage).	Replace the DC Controller.
4. Transfer Roller defective.	Replace the Transfer Roller.

Table 7-27 Character Voids

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Bad transparencies. Transparencies can have this problem because they are not designed for proper toner adhesion.	Use Hewlett-Packard approved transparencies (refer to "Media Specifications" in Chapter 2).
2. Printing on wrong side of paper. The label on the ream of paper indicates which side to print on. The different surface properties of some papers may cause problems if loaded wrong side up.	Check for the arrow on the paper wrapper. Be sure paper is loaded with the **arrow pointing down** in the paper cassette.
3. Bad paper lot. The surface of the paper may be too smooth or rough for proper toner adhesion.	Try a different paper lot (see "Media Specifications" in Chapter 2).
4. Bad Transfer Roller. If the Transfer Roller has finger oils on its surface, is dirty or is worn-out, this problem can result.	Clean the Transfer Roller using a **dry, lint-free cloth**. DO NOT touch the Transfer Roller with your fingers. If the problem persists, replace the Transfer Roller Assembly.

Table 7-28 Background Scatter

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Bad Media. The moisture content, conductivity or surface finish may not work correctly with the electrophotographic process.	Try a different media (see "Paper Specifications" in Chapter 2).
2. Inside of printer is dirty (toner may have leaked out of the toner cartridge).	Clean inside of printer (see Chapter 4). Install a new toner cartridge if leaking.
3. Printing on envelope seams. Printing on an envelope seam can cause a background scatter problem.	Move the text to an area without seams. If not printing on seams, try a higher print density setting (see item 6, below).
4. Defective toner cartridge.	Install a new toner cartridge.
5. Dirty or worn Transfer Roller. A worn Transfer Roller can cause background due to improper bias voltages.	Clean the Transfer Roller using a dry, lint-free cloth. DO NOT touch the Transfer Roller with your fingers. If the problem persists, replace the Transfer Roller Assembly.
6. Print Density set too low. If the Print Density is set too low, then background scatter can result, particularly with envelopes and heavier papers.	Adjust the print density to a higher setting through software, through the Print Quality menu of the HP Explorer Remote Control Panel, or through the front control panel (LaserJet 4P/4MP).

Table 7-29 Bottom Portion of Page Blank

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Page too complex. The printer can not create the image fast enough to keep pace with the print engine.	Set Page Protect to ON or AUTO through the HP Explorer Remote Control Panel.
2. Not enough memory. The page is too complex for standard printer memory.	Add printer memory. As an alternative, simplify the print job.
3. Printing on legal-size paper when software is specifying letter size. (This will also cause paper jams.)	Review software selection. Ensure that printing is on selected size.

Table 7-30 Faulty Registration

Symptoms of faulty registration are print images which are not skewed (parallel to the paper path), but which begin printing (leading edge) either too early or too late.

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Overloaded paper cassette. If the cassette is overloaded, the Pickup Rollers may not pick the paper up correctly.	Reload proper amount of paper **squarely** in the cassette. Review paper loading with the customer.
2. Paper guide on the paper cassette adjusted too tight. If the guide is pushing too tightly against the paper, it may be delayed in being pulled into the printer.	Verify that the paper guide is adjusted for the correct paper size and is locked into position. Note that too loose a setting may cause image skewing.
3. Paper does not meet specs. The surface of the paper may be too smooth for the Pickup and Feed Rollers to correctly feed paper into the printer.	Try a different paper lot (see "Media Specifications" in Chapter 2).
4. Registration adjustment is required.	If the top of the page does not begin printing within the proper distance from the leading edge of the paper, then a registration adjustment is required. Refer to "Leading Edge Adjustment," later in this chapter.
5. Worn or broken drive gears. If any gear within the drive train or paper path becomes excessively worn or dirty, erratic paper movement can result.	Replace the defective gear, if available, or the Drive Train Assembly.
6. Worn Pickup, Oblique, and/or Registration Rollers. Paper is not being picked-up consistently.	Inspect all paper path rollers, looking for wear, cracks, or glazing. Replace the worn rollers.

Table 7-31 Smeared Print

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Bad media. The moisture content, conductivity, or surface finish of the media being printed may not work correctly with the electrophotographic process.	Try a different paper lot or other media (see "Media Specifications" in Chapter 2).
2. Dirty Fusing Rollers. Toner build-up can cause the print on a page to smear.	Remove and inspect the Fusing Assembly for excessive toner build-up. Clean using alcohol.
3. The Static Eliminator Strip is dirty or is not grounded, allowing a static charge to remain on the page.	Clean or replace the Static Eliminator Strip. Use compressed air to clean (see "Static Eliminator Strip" in Chapter 6).
4. Fusing Assembly is defective. The print will smear if the Fusing Assembly is not heated sufficiently to bond the toner image to the paper.	Replace the Fusing Assembly.
5. DC Controller is defective. The DC Controller regulates fusing roller temperature.	If a new Fusing Assembly does not resolve the problem, replace the DC Controller PCA.

Table 7-32 Image Skew

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Paper is loaded incorrectly. If the paper is not installed flush into the paper cassette, a skewing problem will result.	Remove paper from the tray and install paper correctly. Position the paper guide correctly for the paper size being used.
2. Bad Paper Lot. Paper that is manufactured poorly or inconsistently, or that has too smooth or too rough a surface texture can cause an image skew problem.	Try a different paper lot (see "Media Specifications" in Chapter 2).
3. Worn Pickup, Oblique, and/or Registration Rollers. Paper is not being picked-up consistently.	Inspect all paper path rollers, looking for wear, cracks, or glazing. Replace the worn rollers.
4. Beam-to-Drum Mirror adjustment is required. If the mirror has been removed, or the right end mounting screw has been loosened, the mirror needs to be readjusted.	Refer to "Beam-to-Drum Mirror Adjustment," later in this chapter to adjust the image to proper tolerances.
5. Manual feed skew problems.	Instruct customer to feed media against left side alignment guide, and **not to reinsert** once the printer "grips" the media.

Table 7-33 Compressed Print

POSSIBLE CAUSE	RECOMMENDED ACTION
1.Toner cartridge bushings are too tight. This may occur on refilled toner cartridges.	Replace the toner cartridge.
2. Broken or worn gear.	Inspect and replace the worn gear or assembly.

Engine Test

The engine test print is used to verify that the print engine is functioning correctly. The Formatter PCA is completely bypassed during an engine test. This test is therefore very useful for isolating printer problems. The engine test prints a full page of vertical lines down the entire printable area, and is thus also useful for checking and adjusting registration.

Engine Test Button Location

The engine test print button(SW301) is located on the side of the DC Controller PCA (see Figure 7-2). It is accessible through a hole in the Gear Train plate.

Printing an Engine Test - LaserJet 4L/4ML

On the LaserJet 4L/4ML, the engine test button is accessible **without removing the covers,** through the I/O Door area on the left side of the printer. To print an engine test, use a long object (such as a pencil) to press the engine test button (see Figure 7-4). **(Do not use a metal object.)** A single test page is printed.

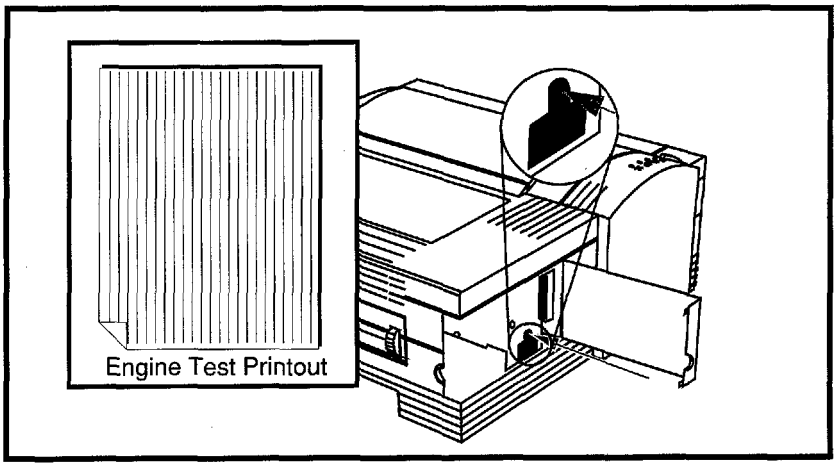


Figure 7-4 Engine Test Button and Printout, LaserJet 4L/4ML

Printing an Engine Test - LaserJet 4P/4MP

On the LaserJet 4P/4MP, the printer's covers and the Formatter PCA must be removed prior to printing an Engine Test. Since the covers will be removed, the printer's safety interlocks must be defeated to provide power for running the Engine Test.

To defeat the interlocks and set-up the printer for an Engine Test:

1. Remove the printer cover, the Formatter Shield and the Formatter PCA (see Chapter 6).

2. Install the paper cassette (with paper loaded).

3. Install a toner cartridge in the printer. Lay a large sheet of thick paper over the toner cartridge and Laser/Scanner Assembly to block out ambient room light (this will prevent black streaks on the printed output).

4. On the top of the printer, use a piece of tape to hold down the Top Door Plunger (shown in Figure 7-5).

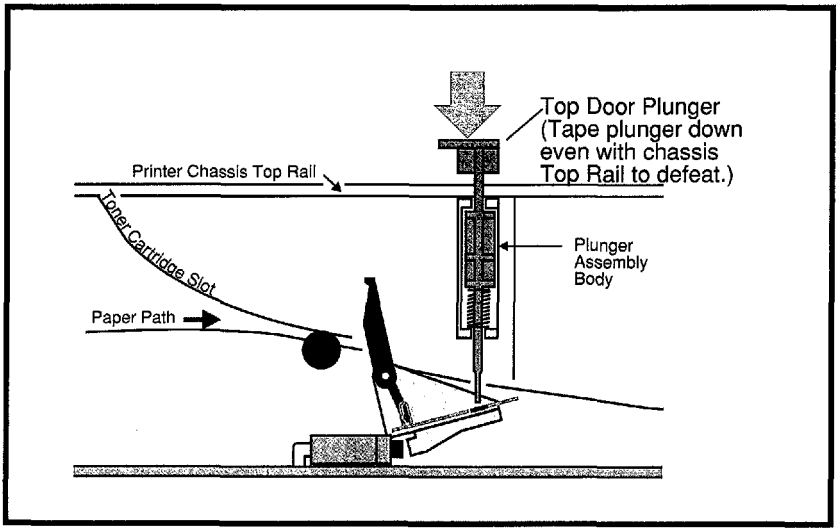


Figure 7-5 Defeating the Top Door Plunger (LaserJet 4P/4MP)

5. On the rear of the Fusing Assembly, use a pencil or flat-blade screwdriver to press the flag mechanism for the Exit Paper Sensor (PS3) in **just until it is about flush with the face of the fuser** (see Figure 7-6).

Note

Do not push the PS3 flag in more than about 1/8 inch (3 mm). If PS3 is pressed in too far, the printer will register a power-on jam and the Engine Test will not print. If this occurs, decrease the depth of the PS3 flag, power-cycle the printer, then retry the Engine Test.

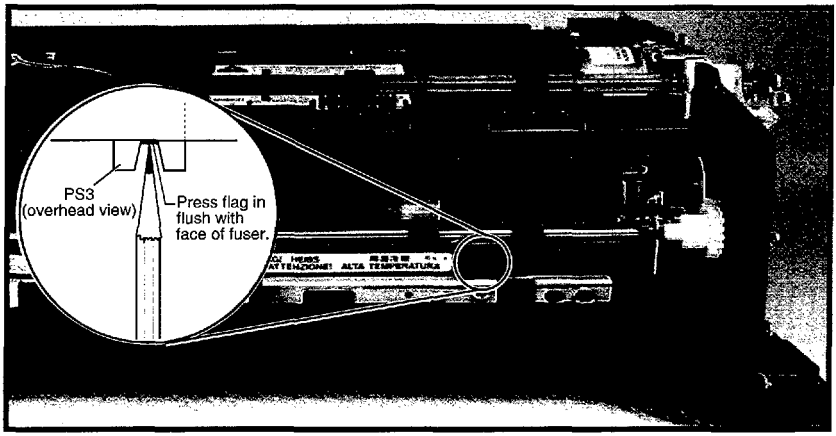


Figure 7-6 Defeating the Exit Sensor Flag (LaserJet 4P/4MP)

6. Plug the ac power cord into the printer.

7. Exert downward pressure on the the toner cartridge (through the light-blocking paper) while pressing the Engine Test button SW301 . Use a pencil or other non-metallic object to reach through the access hole in the Gear Train plate (similar to that shown in Figure 7-4).

8. If the single page Engine Test does not print, power-off the printer, check the Top Door Plunger to be sure it is held all the way down (step 4), and adjust the depth of the Exit Paper Sensor flag as described in step 5.

Half Self Test Functional Check

The electrophotographic process can be subdivided into the following stages:

Cleaning (Physical and Electrostatic).

- Conditioning (Primary Charge Roller).
- Writing (Laser Modulation).
- Development (Formation of the Toner Image).
- Transfer (Charge to transfer the image to paper).

The purpose of the Half Self Test Check is to determine which process is malfunctioning. Perform the test as follows:

1. Initiate a printer front panel self test.
2. Open the printer's Top Door after the paper advances half-way through the printer (about ten seconds after the Main Motor begins rotation). The leading edge of the paper should have advanced past the toner cartridge.
3. Remove the toner cartridge.
4. Open the toner cartridge's drum shield to view the drum's surface.

If a *dark and distinct toner image is present* on the drum's surface, assume that the first three functions of the electrophotographic process are functioning (conditioning, writing and developing - see Chapter 5), and troubleshoot the failure as a transfer problem.

If *NO image is present* on the photoconductive drum, perform the checks shown on the following pages.

Drum Rotation Functional Check

The photoconductive drum, located in the toner cartridge, must rotate for the print process to work. The photoconductive drum receives its drive from the Main Motor gear train. To verify whether the drum is rotating:

1. Open the printer's Top Door.
2. Remove the toner cartridge.
3. Mark the cartridge's drive gear with a felt-tipped marker. Note the position of the mark.
4. Install the toner cartridge, and close the Top Door. The start-up sequence should rotate the drum enough to move the mark.
5. Open the printer, and inspect the gear that was marked in step 3. Verify that the mark moved.

If the mark did not move, inspect the gear train to ensure that it is meshing with the toner cartridge gears. If the printer's drive gears appear functional, and the drum does not move, replace the toner cartridge.

Note This test is especially important if refilled toner cartridges have been used.

High-Voltage Power Supply Check

The High-Voltage Power Supply circuitry, on the DC Controller PCA, provides the necessary voltages for the printer's electrophotographic processes. A method for verifying the high-voltage system is given in the table below.

Table 7-34 High-Voltage System Checks

CHECKS	ACTION
1. Toner cartridge connection points.	Visually inspect the three connection points on the underside, right end of the toner cartridge. If they are dirty or corroded, clean the connections. Clean using alcohol only. If damaged, replace the toner cartridge.
2. High Voltage Connector Assembly.	The High Voltage Connector Assembly mounts on the DC Controller PCA and uses spring-loaded pins to contact the toner cartridge (see Figure 7-2 for locations). Verify that the pins are not dirty or corroded, and that the spring-loading action is functional. If the pins are dirty, clean using alcohol only; if damaged, replace the High Voltage Connector Assembly (see Chapter 6 for procedure).

Paper Curl

Paper curl is inherent to the laser printing processes, and occurs when paper is subjected to heat. Paper curl tends to relax as the paper cools while resting on a flat surface. The specification for maximum paper curl when the paper is lying flat before print is 5 mm (0.2 inches).

Although paper curl cannot be totally eliminated, some steps can be taken to lessen its impact, as suggested in the following table.

Table 7-35 Causes of Paper Curl

POSSIBLE CAUSE	RECOMMENDED ACTION
1. Paper Path	Try using the face-up paper delivery slot to shorten and simplify the paper path.
2. Paper Surface	The recommended printing surface of the page is usually marked on the end of a ream of paper, indicated by a small arrow and the phrase "print this side first." Load paper in the Paper Cassette with the recommended **printing surface facing down** (facing up in the manual feed slot).
3. Paper Storing and Handling	Over time, paper assumes the characteristics of its storage environment (in a humid environment, paper absorbs moisture; in a dry environment, paper loses moisture). Paper with higher moisture content will tend to curl more. Evaluate the storage conditions of the paper.
4. Paper Type	All paper is manufactured differently (different textures, moisture content, drying processes, composition, etc.). Change the type of paper being used and re-evaluate the paper curl results.

Adjustment Procedures

Leading Edge Adjustment

The distance from the leading edge of a sheet of paper to the beginning of the printable area can be adjusted using VR301 located on the DC Controller PCA. Leading edge is set at the factory for new units and only needs adjustment when the DC Controller is replaced. VR301 can be accessed without removing any printer assemblies (other than the paper cassette).

1. Run a printer engine test (see "Engine Test" earlier in this chapter). Measure the leading edge distance (see Figure 7-7). If the distance is 1.5 to 2.5 mm, no adjustment is necessary.
2. If adjustment is needed, remove the paper cassette from the printer by sliding it all the way out.
3. Locate the access hole for VR301 (see Figure 7-7).
4. Turn VR301 clockwise to decrease the leading edge distance, or counter-clockwise to increase (see Figure 7-7).
5. Replace the paper cassette and run another test to compare.
6. Repeat 1 through 5 until the leading edge is within tolerance.

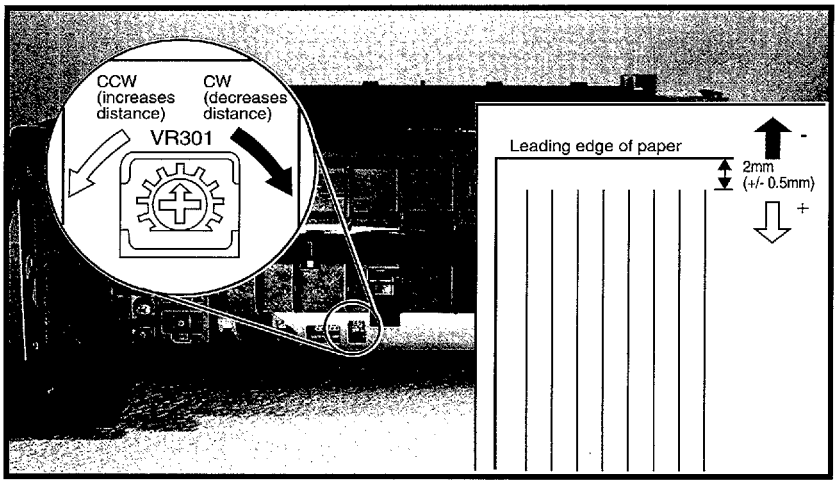


Figure 7-7 Leading Edge Adjustment

Beam-to-Drum Mirror Adjustment

The mounting for the Beam-to-Drum mirror has an adjustment on the right end to correct for potential image skew problems. The mirror is adjusted at the factory for new units, but can lose its setting if the mirror is removed for any reason, or if the adjustment screw has been loosened.

To adjust the Beam-to-Drum Mirror:

1. Run a test print (an "Engine Test," described earlier in this chapter, or another self test print, described in Chapter 3).

2. Use a pencil or pen to draw a horizontal line across the top of each vertical line on the test print image (see Figure 7-7).

3. Place the edge of a tool with an exact 90 degree corner (such as a drafting triangle) along the leftmost vertical line of the test print image, and draw a second horizontal line across the top of the page.

4. Measure the error between the lines drawn in step 2 and step 3 (see Figure 7-8). If the distance is greater than 1.5 mm, then adjustment is needed.

5. On the right end of the mirror assembly, note the current adjustment setting (if necessary, make a mark on the printer body and/or adjustment scale), and loosen the adjustment screw.

6. Shift the mirror toward the front of the printer to move the image up on the right, or toward the back of the printer to move the image up on the left.

7. Run another test print, repeating the above steps until the image skew is within tolerance.

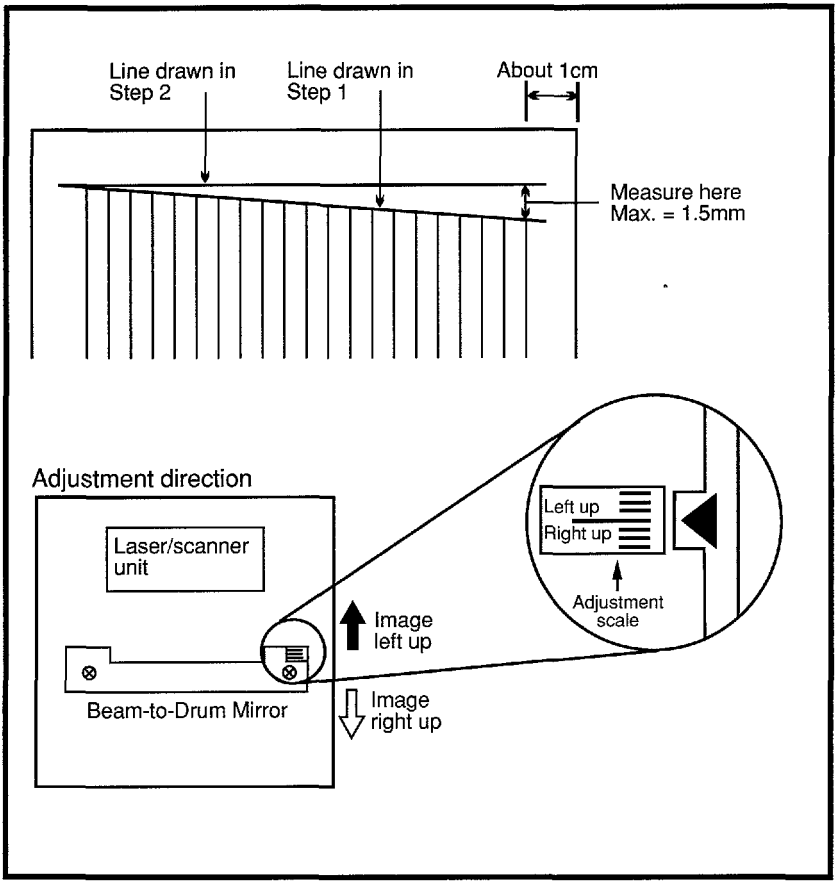


Figure 7-8 Beam-to-Drum Mirror Adjustment

Troubleshooting Tools

Repetitive Image Defect Ruler

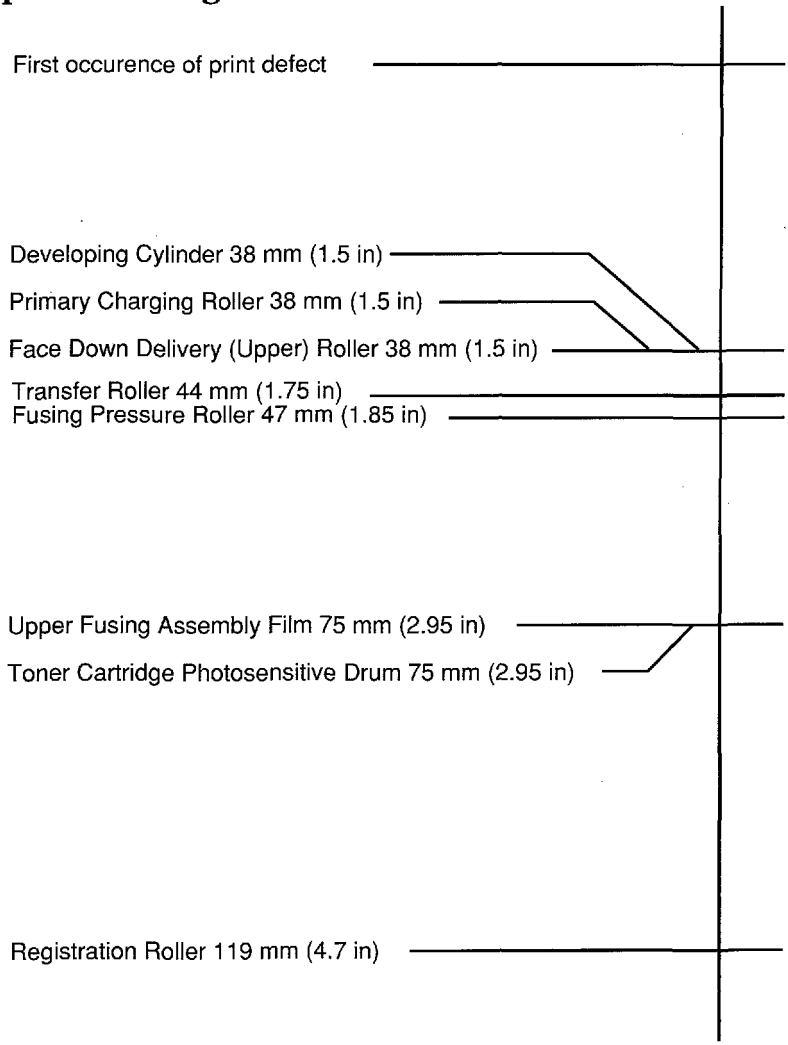


Figure 7-9 Repetitive Image Defect Ruler

Main Wiring Diagram

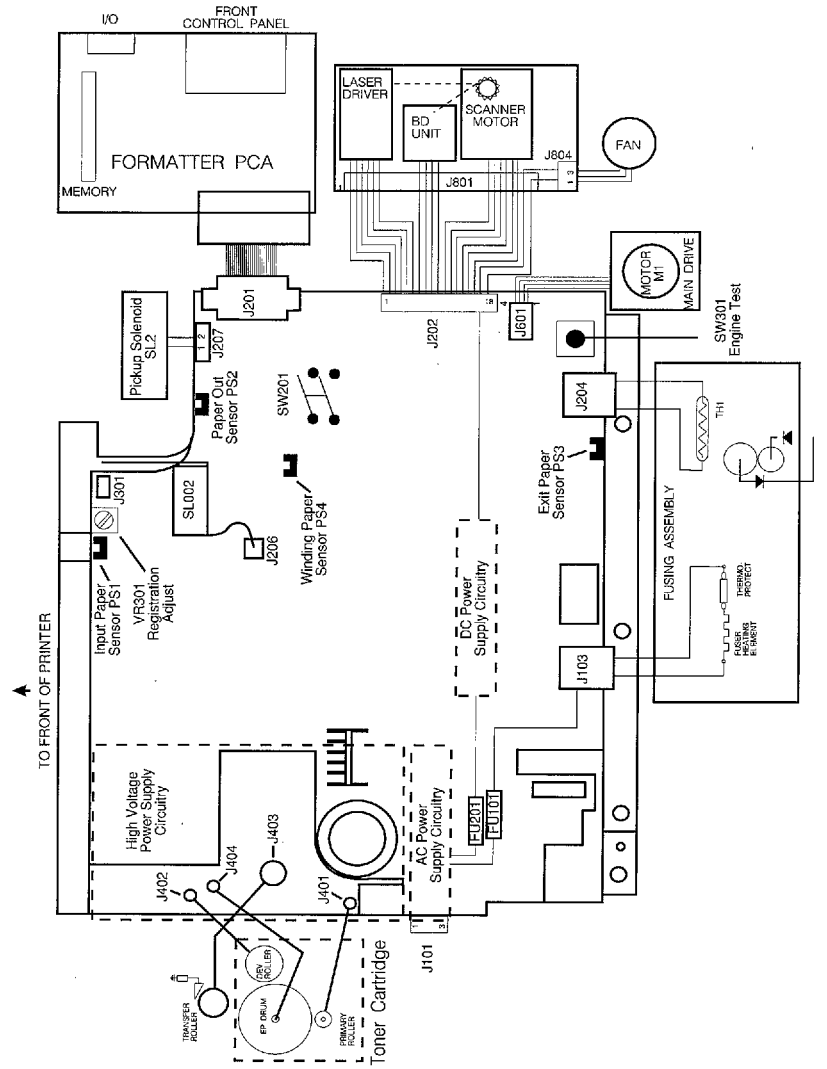


Figure 7-10 Main Wiring Diagram (generalized)

8

Parts and Diagrams

How to Use the Part Lists and Diagrams

The figures in this chapter illustrate the major subassemblies in the printer and their component parts. A table (material list) follows each exploded assembly diagram. Each table lists the reference designator (item number) for each part, the associated part number for the item, the quantity, and a description of the part.

While looking for a part number, pay careful attention to the voltage listed in the description column to ensure that the part number selected is for the correct model of printer.

Ordering Parts

All standard part numbers listed are stocked and may be ordered from HP's Parts Direct Ordering, or Parts Center Europe (PCE).

Hewlett-Packard Co.
Support Materials Organization
8050 Foothills Blvd.
Roseville, CA 95678
Parts Direct Ordering: 1-800-227-8164 (U.S. Only)

Hewlett-Packard Co.
Parts Center, Europe
Wolf-Hirth Strasse 33
D-7030 Boeblingen, Germany
(49 7031) 14-2253

Contact your local HP Parts Coordinator for other local phone numbers.

Ordering Consumables

Consumables and accessories such as those listed on page 8-5, and in Table 4-1, Chapter 4, may be ordered direct from Hewlett-Packard. The phone numbers are:

U.S: 1-800-538-8787
Canada: 1-800-387-3154
(Toronto) 416-671-8383
United Kingdom: 0734-441212
Germany: 0130-3322

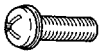
Contact your local HP Parts Coordinator for other local phone numbers.

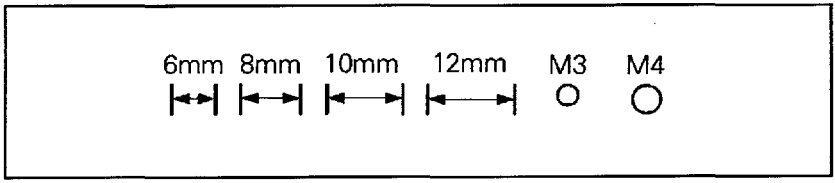
Note

Parts that have no reference designator or part number are not field replaceable parts and cannot be ordered through SMO.

Common Hardware

Table 8-1 Common Fasteners Used in the Printer

DRAWING	DESCRIPTION	SIZE	NOTES	PART NO.
	Phillips pan-head machine screw.	M3X6	E-20 in drawings	XB1-2300-607CN
	Phillips washer-head machine screw.	M3X12 M3X8	Formatter PCA Formatter PCA	0515-2419 0515-2251
	Phillips machine screw with captive star washer.	M3X10 M3X6 M3X6 M3X8	Fuser Assembly Feeder Gde Ground Gear Train Ground Fuser Ent Guide	XA9-0654-000CN XA9-0653-000CN XB2-7300-606CN XB2-8300-809CN
	Self-tapping Phillips screw.	M4X10 M4X12 M3X8	G-32 in drawings Laser/Scanner G-17 in drawings	XB4-7401-007CN XB4-7401-209CN XB4-7300-809CN



Accessories and Supplies

The following items are available through your local authorized HP dealer. To find a dealer near you (or if your dealer is temporarily out of stock), call the HP Customer Information Center (800) 752-0900.

Note Refer to "Ordering Related Documentation" in Chapter 1 for documentation part numbers.

92274A	HP Toner Cartridge
C2024A C2024-69001	1 Mb memory upgrade, LaserJet 4L only (New) 1 Mb memory upgrade, LaserJet 4L only (Exchange)
C3130A* C3131A* C3132A* C3133A*	1 Mb Memory SIMMs (LaserJet 4P/4MP only) 2Mb Memory SIMMs (LaserJet 4P/4MP only) 4Mb Memory SIMMs (LaserJet 4P/4MP only) 8Mb Memory SIMMs (LaserJet 4P/4MP only)
2049-67901**	Adobe PostScript Level 2 SIMM (LaserJet 4P only)
R75-0010-000CN	Universal Paper Cassette (LaserJet 4L/4ML only)
R75-2010-000CN	Universal Paper Cassette (LaserJet 4P/4MP only)
24542D	Parallel cable, 2 meter (Bi-tronics compatible)
C2932A	Serial Cable 9-9 pin M/F (LaserJet 4P/4MP only)
C2933A	Serial Cable 9-25 pin M/F (LaserJet 4P/4MP only)
8120-6177	Right angle 110v power cord (4L/4ML only)
RF5-0690-000CN	Cleaning Brush
RB1-3389-000CN	Velcro Adhesive Cleaning Brush Holder

*C206XA SIMMs (36 bit) are also supported, however, C303XA SIMMs (32 bit) are recommended.
**This PostScript SIMM is not compatible with any other printers (4P only).

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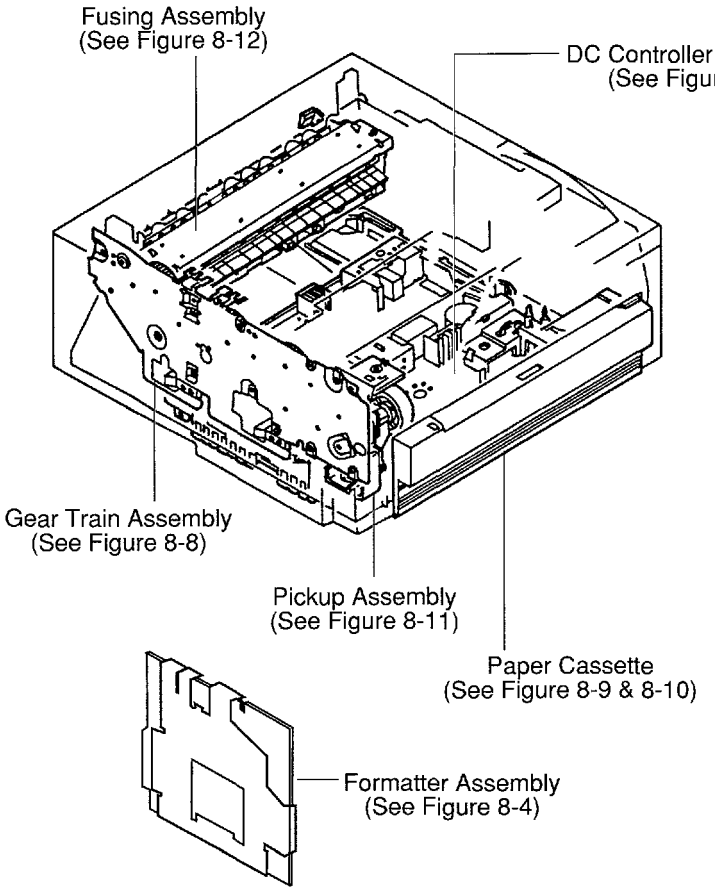

Figure 8-1 Assembly Locations (LaserJet 4L shown)

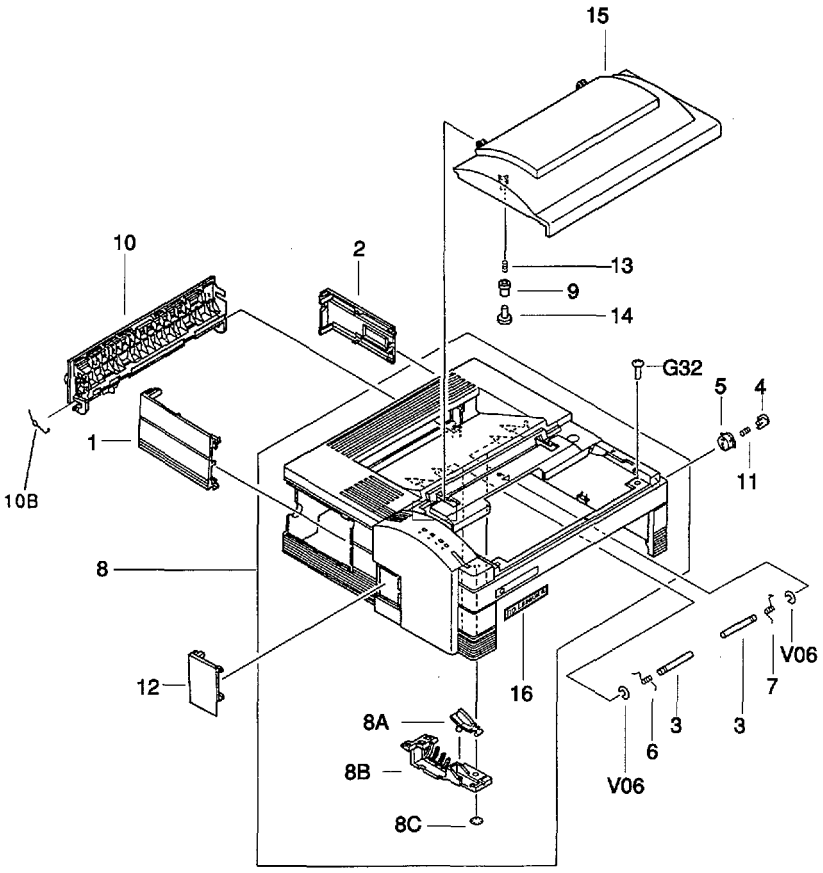

Figure 8-2 Covers and Doors (LaserJet 4L/4ML only)

Table 8-2 Covers and Doors (LaserJet 4L/4ML only)

REF	PART NO.	QTY	DESCRIPTION
	RG5-0685-000CN	1	Cover Assembly*
1	RB1-2977-000CN	1	Door, I/O
2	RB1-2978-000CN	1	Door, Power
3	RB1-3131-000CN	2	Shaft, Top Door Hinge
4	RB1-3132-000CN	1	Button, Lock
5	RB1-3133-000CN	1	Guide, Lock Button
6	RB1-3134-000CN	1	Spring, Left Torsion
7	RB1-3135-000CN	1	Spring, Right Torsion
8	RF5-0597-000CN	1	Cover, Main
8A	RB1-3128-000CN	1	Front Panel Button
8B	RB1-2976-000CN	1	Light Pipe
8C	XD2-2300-402CN	3	Washer, SE Ring
9	RB1-3130-000CN	2	CRG Pressure Piece
10	RG5-0691-000CN	1	Door, Back Assembly
10B	RB1-3138-000CN	1	Spring, Torsion
11	RS5-2228-000CN	1	Spring, Top Door Latch
12	RB1-2979-000CN	1	Door, Memory
13	RS5-2227-000CN	2	Spring, Top Door Compression
14	XA9-0634-000CN	2	Screw, Top Door
15	RB1-3129-000CN	1	Door, Top
16	C2003-00005	1	Nameplate, LaserJet 4L
16	C2015-00001	1	Nameplate, LaserJet 4ML
V06	XD2-1100-242CN	2	E-Clip

*Cover assembly does not include items 1, 2 and 12.

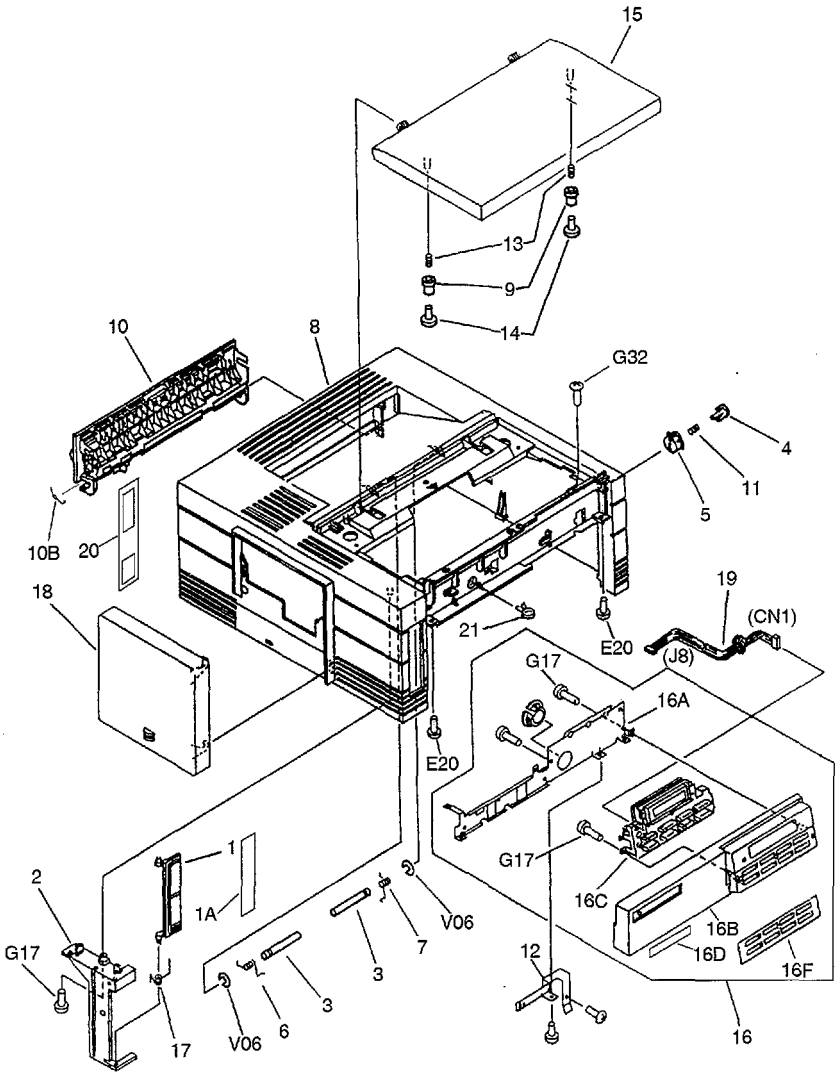

Figure 8-3 Covers and Doors (LaserJet 4P/4MP only)

Table 8-3 Covers and Doors (LaserJet 4P/4MP only)

REF	PART NO.	QTY	DESCRIPTION
	RG5-0810-000CN	1	Cover Assembly
1	RB1-3352-000CN	1	Cover, Font
1A	C2040-40002	1	Font Door Plug, LaserJet 4MP
2	RB1-3353-000CN	1	Hinge, Font Cover
3	RB1-3131-000CN	2	Shaft, Top Door Hinge
4	RB1-3356-000CN	1	Button, Lock
5	RB1-3357-000CN	1	Guide, Lock Button
6	RB1-3798-000CN	1	Spring, Left Torsion
7	RB1-3799-000CN	1	Spring, Right Torsion
8	RF5-0681-000CN	1	Cover, Main
9	RB1-3130-000CN	2	CRG Pressure Piece
10	RG5-0691-000CN	1	Door, Back Assembly
10B	RB1-3138-000CN	1	Spring, Torsion
11	RS5-2228-000CN	1	Spring, Top Door Latch
12	RB1-3417-000CN	1	Plate, Grounding
13	RS5-2227-000CN	2	Spring, Top Door Compression
14	XA9-0634-000CN	2	Screw, Top Door
15	RB1-3332-000CN	1	Door, Top
16	RG5-0812-000CN	1	Control Panel Assembly
16A	RB1-3416-000CN	1	RFI Shield, Control Panel PCA
16B	RF5-0682-000CN	1	Bezel Assembly
16C	RG5-0816-000CN	1	Control Panel PCA
16D	C2005-00006	1	Nameplate, LaserJet 4P
16D	C2040-00001	1	Nameplate, LaserJet 4MP
16F	*(see Table 8-13)*		Keyboard Overlay (Localized)
17	RS5-2255-000CN	1	Spring, Font Door Torsion
18	RG5-0813-000CN	1	SIMM Cover Assembly
19	RG5-0815-000CN	1	Display Cable
20	C2005-40001	1	I/O Cover Plate, LaserJet 4P
20	C2040-40001	1	I/O Cover Plate, LaserJet 4MP
V06	XD2-1100-242CN	2	E-Clip

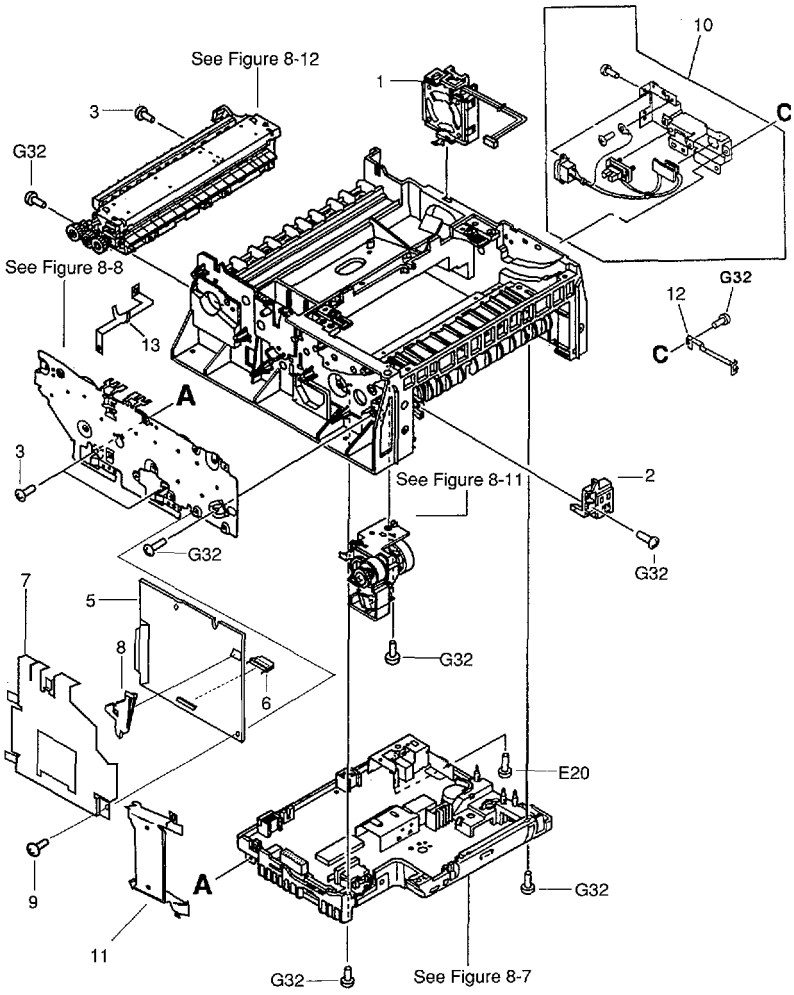

Figure 8-4 Internal Components 1

Table 8-4 Internal Components 1

REF	PART NO.	QTY	DESCRIPTION
1	RG5-0703-000CN	1	Fan Assembly
2	RG5-0669-000CN	1	Front Oblique Roller Assembly
3	XA9-0654-000CN	**	Screw, M3X10
5	C2004-67901 C2004-69001 C2016-67901 C2016-69001 C2006-67901 C2006-69001 C2041-67901 C2041-69001	1	Formatter PCA: LaserJet 4L (New) LaserJet 4L (Exchange) LaserJet 4ML (New)* LaserJet 4ML (Exchange)* LaserJet 4P (New)* LaserJet 4P (Exchange)* LaserJet 4MP (New)* LaserJet 4MP (Exchange)*
6	1252-5278 1252-5460	1	DC Controller Connector LaserJet 4L/4ML LaserJet 4P/4MP
7	C2003-00032 C2015-00002 C2015-00003 C2005-00013	1	RFI Shield: LaserJet 4L LaserJet 4ML* LaserJet 4ML, Mini DIN* LaserJet 4P/4MP*
8	C2003-40001	1	Switch Acutuator (LaserJet 4L/ML)
9	0515-2419 0515-2251	**	Screw, washer-head long (12 mm) short (8 mm)*
10	RG5-0805-000CN	1	Power Switch (LaserJet 4P/4MP)
11	C2005-00004	1	Font Guide (LaserJet 4P/4MP)
12	RB1-3405-000CN	1	Grounding Plate (LaserJet 4P/4MP)
13	RB1-3404-000CN	1	Grounding Plate (LaserJet 4P/4MP)

*Part shown in Figure 8-4 is for other printer model; actual part looks different.
**Quantity varies - dependent on printer model.

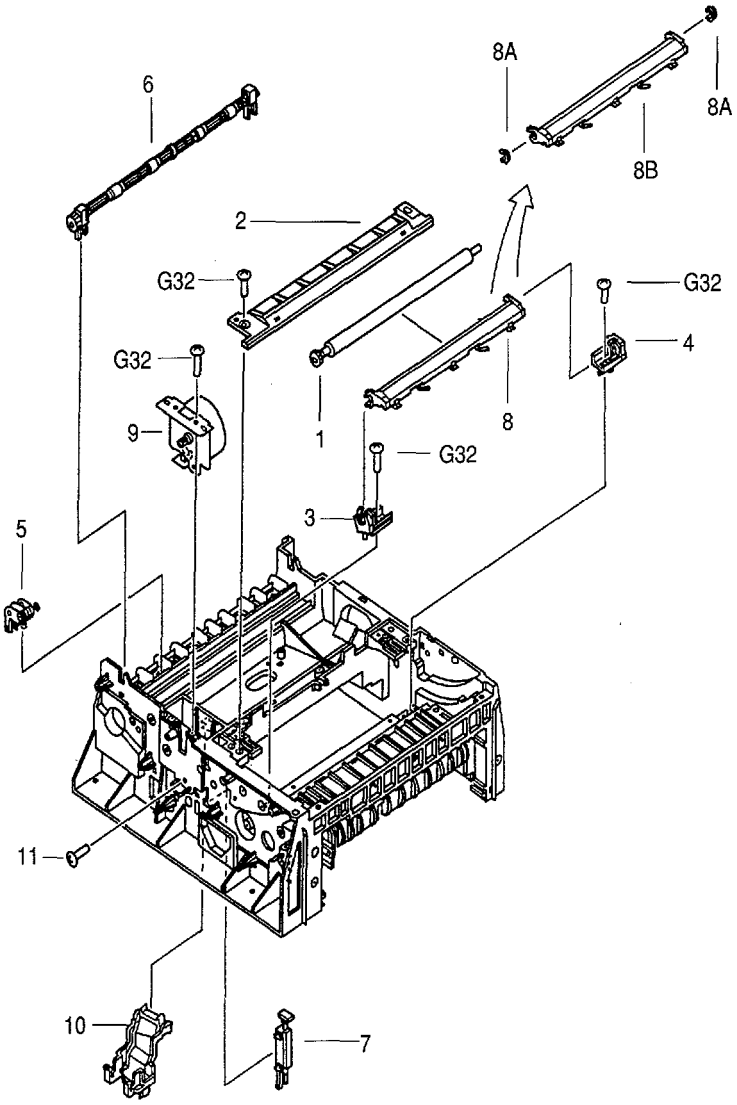

Figure 8-5 Internal Components 2

Table 8-5 Internal Components 2

REF	PART NO.	QTY	DESCRIPTION
1	RF5-0596-000CN	1	Roller, Transfer Assembly *
2	RG5-0667-000CN RG5-0802-000CN	1	Beam-to-Drum Mirror Assembly: LaserJet 4L/4ML LaserJet 4P/4MP
3	RG5-0674-000CN	1	Mount, Transfer Assembly, Left
4	RG5-0675-000CN	1	Mount, Transfer Assembly, Right
5	RG5-0682-000CN	4	Roller, Lower Output Assembly
6	RG5-0683-000CN	1	Roller, Upper Output Assembly
7	RG5-0694-000CN	1	Switch, Plunger Assembly
8	RG5-0702-000CN	1	Transfer Guide Assembly
8A	RB1-3073-000CN	2	Bushing
8B	RF5-0585-000CN	1	Transfer Guide
9	RG5-0764-000CN	1	Motor, Main Assembly
10	RG5-0766-000CN	1	Scanner Connector Assembly
11	XA9-0495-000CN	1	Screw, Main Motor

* Includes drive gear.

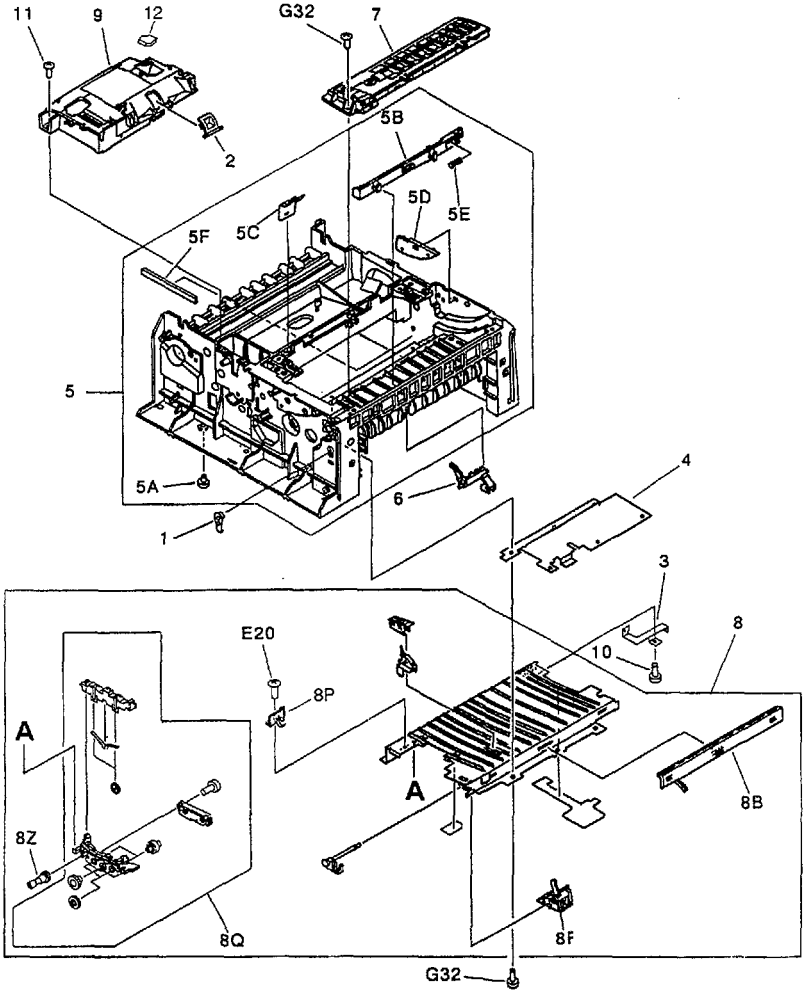

Figure 8-6 Internal Components 3

Table 8-6 **Internal Components 3**

REF	PART NO.	QTY	DESCRIPTION
1	RB1-2971-000CN	1	Bushing, D-roller
2	RB1-3681-000CN	1	Cap, Laser Shutter
3	RB1-2984-000CN RB1-3403-000CN	1	Plate, Fuser Ground: LaserJet 4L/4ML LaserJet 4P/4MP
4	RB1-2987-000CN	1	Shield, High Voltage
5	RG5-0805-000CN	1	Plate, Gear Plate Ground
5A	RB1-3001-000CN	4	Foot, Chassis
5B	RB1-3002-000CN	1	Plunger Lock, Door
5C	RB1-3003-000CN	1	Spring, Scanner Leaf
5D	RB1-3004-000CN	1	Plate, CRG
5E	RS5-2232-000CN	1	Spring, Compression
6	RF5-0601-000CN		Arm, Input Paper Sensor
7	RG5-0670-000CN	1	Top Oblique Roller Assembly
8	RG5-0671-000CN RG5-0793-000CN	1	Guide, Feeder Assembly: LaserJet 4L/4ML LaserJet 4P/4MP
8B	RF5-0584-000CN	1	Static Eliminator Assembly
8F	RG5-0672-000CN	1	Switch, Cam Assembly
8Q	RG5-0794-000CN	1	Roller Assy, Small Media (4P/4MP)
8P	RB1-3365-000CN	1	Shaft Holder (LaserJet 4P/4MP)
8Z	RS5-0364-000CN.	1	Drive Gear (LaserJet 4P/4MP)
9	RG5-0662-000CN C2003-69005 RG5-0800-000CN C2005-69005	1	Laser/Scanner Assembly: LaserJet 4L/4ML (New) LaserJet 4L/4ML (Exchange) LaserJet 4P/4MP (New) LaserJet 4P/4MP (Exchange)
10	XA9-0653-000CN	1	Screw, M3X6
11	XB4-7401-209CN	3	Screw, Scanner
12	RB1-3392-000CN	1	Dust Cover, Foam Rubber

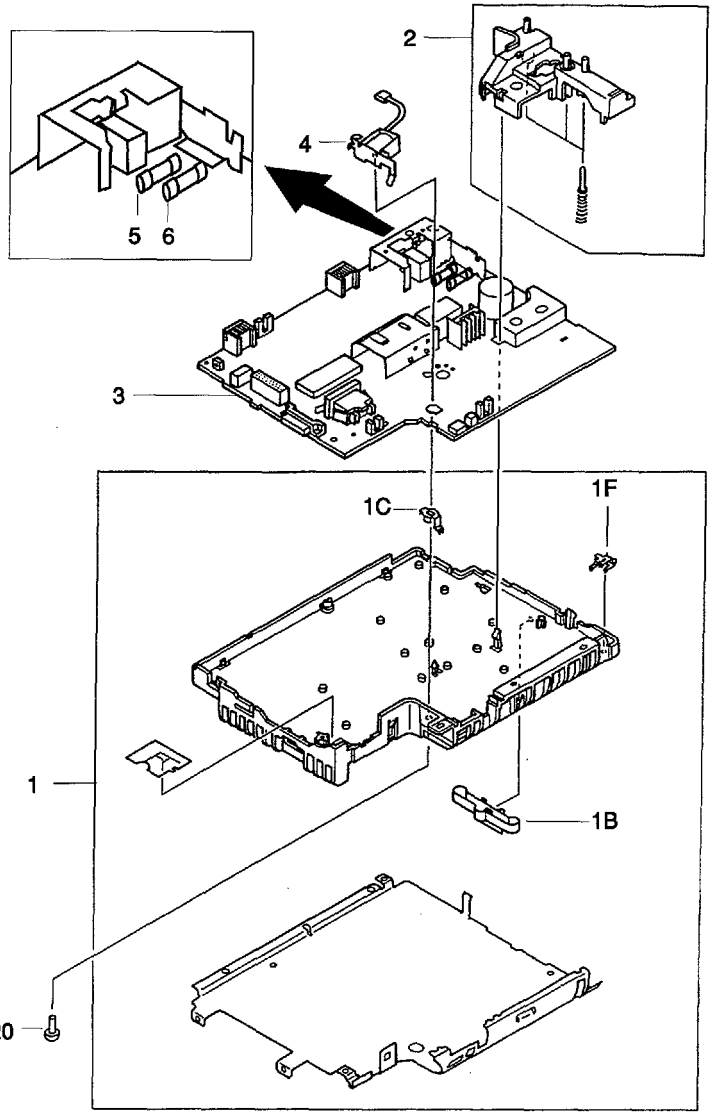

Figure 8-7 DC Controller Assembly

Table 8-7 **DC Controller Assembly**

REF	PART NO.	QTY	DESCRIPTION
1	RG5-0700-000CN	1	DC Controller Case Assembly
1B	RB1-3151-000CN	1	Spring, Cassette Side
1C	RB1-3152-000CN	1	Plate, Solenoid Ground
1F	RB1-3164-000CN	1	Plate, Ground
2	RG5-0701-000CN	1	High Voltage Connector Assembly
3	RG5-0753-000CN C2003-69003 RG5-0822-000CN C2005-69003	1	DC Controller PCA, **100-120V**: LaserJet 4L/4ML (New) LaserJet 4L/4ML (Exchange) LaserJet 4P/4MP (New) LaserJet 4P/4MP (Exchange)
3	RG5-0767-000CN C2003-69004 RG5-0823-000CN C2005-69004	1	DC Controller PCA, **220-240V**: LaserJet 4L/4ML (New) LaserJet 4L/4ML (Exchange) LaserJet 4P/4MP (New) LaserJet 4P/4MP (Exchange)
4	RH7-5092-000CN	1	Pick-up Solenoid (SL2)
5	WD1-0288-000CN	1	Fuse FU101, **100-120V**
5	VD7-0643-151CN	1	Fuse FU101, **220-240V**
6	VD7-0522-501CN	1	Fuse FU201, **100-120V ONLY**

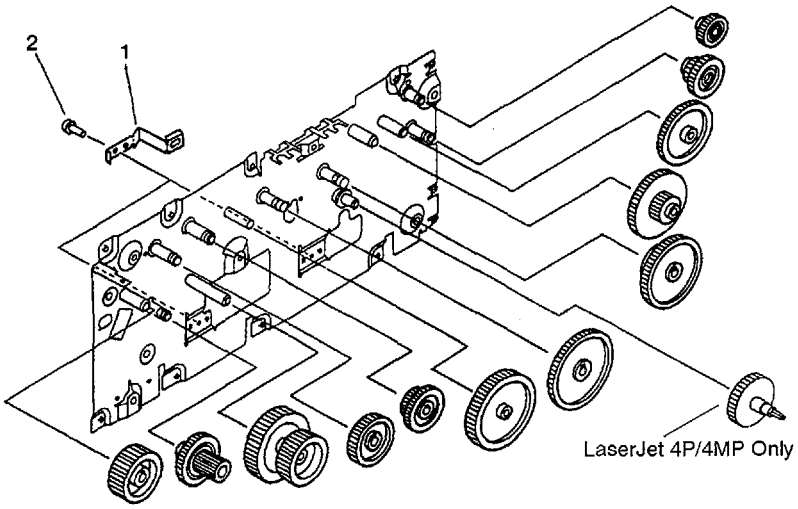

Figure 8-8 Gear Train Plate Assembly

Table 8-8 Gear Train Plate Assembly

REF	PART NO.	QTY	DESCRIPTION
	RG5-0684-000CN RG5-0791-000CN	1	Gear Train Plate Assembly: LaserJet 4L/4ML LaserJet 4P/4MP
1	RB1-3125-000CN RB1-3402-000CN	2	Spring, Leaf LaserJet 4L/4ML LaserJet 4P/4MP
2	XB2-7300-606CN	2	Screw, w/star washer (M3X6)

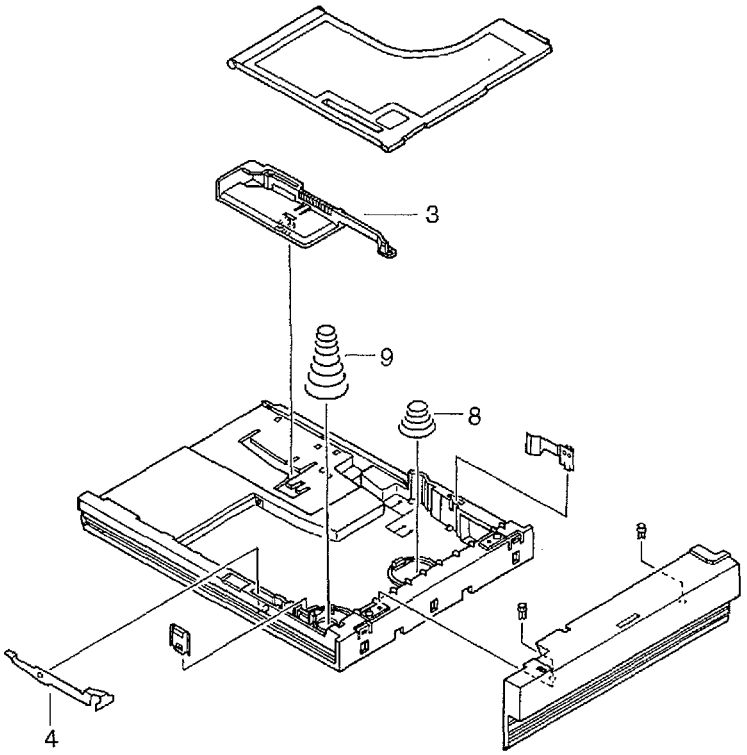

Figure 8-9 Paper Cassette (LaserJet 4L/4ML)

Table 8-9 Paper Cassette (LaserJet 4L/4ML)

REF	PART NO.	QTY	DESCRIPTION
	R75-0010-000CN	1	Universal Paper Cassette
3	RB1-3142-000CN	1	Guide, Forms Size
4	RB1-3143-000CN	1	Claw, Separation
8	RS5-2229-000CN	1	Spring, Compression Small
9	RS5-2230-000CN	1	Spring, Compression Large

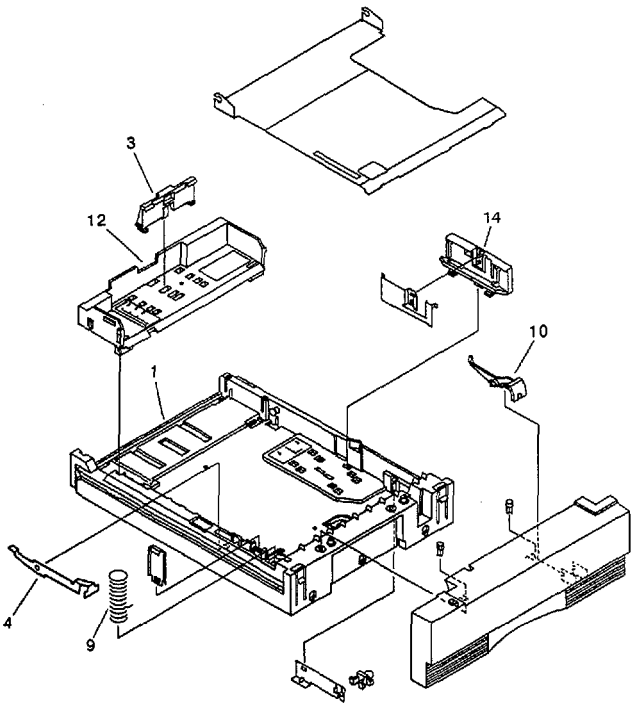

Figure 8-10 Paper Cassette (LaserJet 4P/4MP)

Table 8-10 Paper Cassette (LaserJet 4P/4MP)

REF	PART NO.	QTY	DESCRIPTION
	R75-2010-000CN	1	Universal Paper Cassette
3	RB1-3338-000CN	1	Plate, End
4	RB1-3143-000CN	1	Claw, Separation
9	RS5-2254-000CN	1	Spring, Compression
10	RB1-3339-000CN	1	Lever
12	RB1-3341-000CN	1	Tray, Legal
14	RF5-0673-000CN	1	Plate, Side

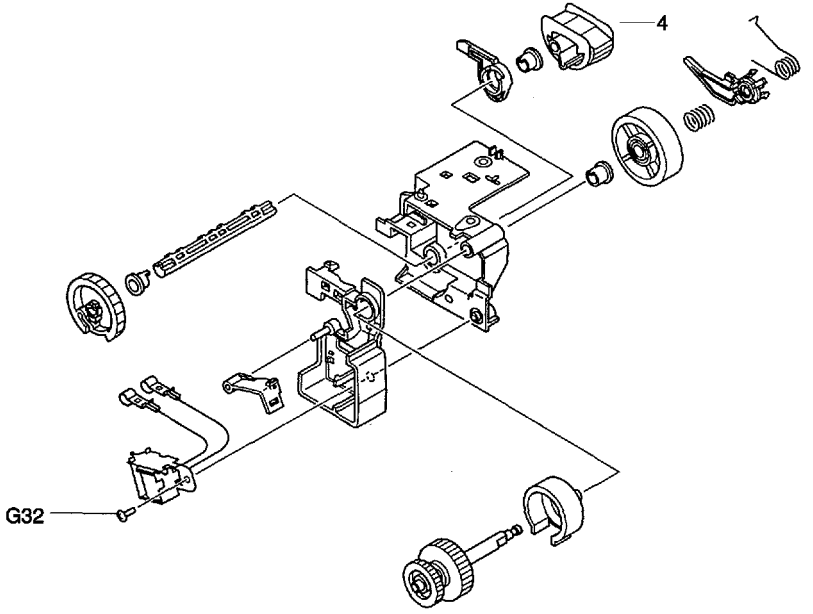

Figure 8-11 Pickup Assembly

Table 8-11 Pickup Assembly

REF	PART NO.	QTY	DESCRIPTION
	RG5-0668-000CN RG5-0796-000CN	1	Pickup Assembly: LaserJet 4L/4ML LaserJet 4P/4MP
4	RB1-3029-000CN RB1-3368-000CN	1	Pickup Feed D-Roller: LaserJet 4L/4ML LaserJet 4P/4MP

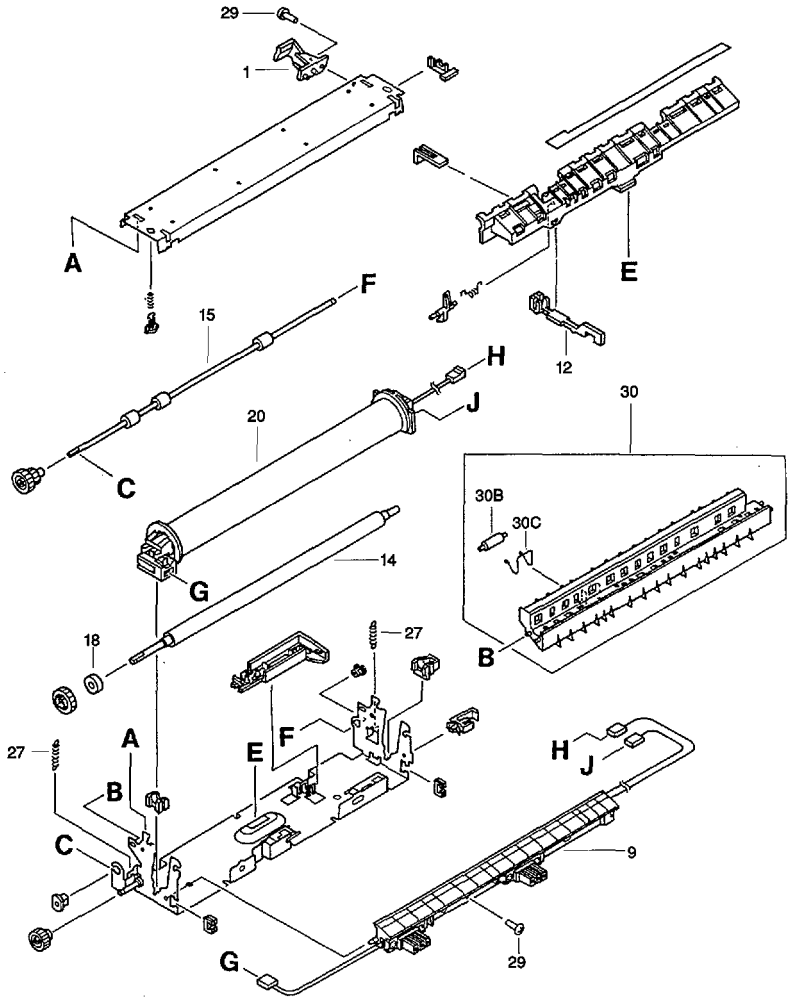

Figure 8-12 Fuser Assembly

Table 8-12 Fuser Assembly

REF	PART NO.	QTY	DESCRIPTION
	RG5-0676-000CN C2003-69001	1	Fuser Assembly, **100-120V**: New Exchange
	RG5-0677-000CN C2003-69002	1	Fuser Assembly, **220-240V**: New Exchange
1	RB1-2981-000CN	1	Tab, Fuser Release
9	RG5-0690-000CN	1	Guide, Fuser Entrance
12	RB1-3097-000CN	1	Flag, Exit Sensor
14	RB1-3100-000CN	1	Roller, Fuser Pressure
15	RB1-3103-000CN	1	Roller, Fuser Delivery
18	RB1-3109-000CN	1	Roller, Fuser Conductive Rubber
20	RG5-0678-000CN RG5-0679-000CN	1	Fuser Film Assembly **100-120V** **220-240V**
27	RS5-2224-000CN	2	Spring, Fuser Hook
29	XB2-8300-809CN	2	Screw, w/star washer (M3X8)
30	RG5-0681-000CN	1	Fuser Delivery Assembly
30B	RB1-3107-000CN	2	Roller, Delivery
30C	RB1-3108-000CN	2	Spring, Delivery

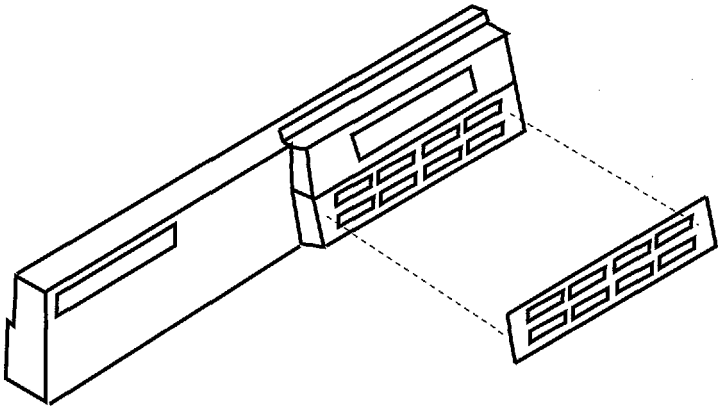

Figure 8-13 Keyboard Overlay (LaserJet 4P/4MP)

Table 8-13 Keyboard Overlays (LaserJet 4P/4MP)

REF	PART NO.	QTY	DESCRIPTION
1		1	Keyboard Overlay:
	C2005-40002		Euro-English
	C2005-40003		Turkish
	C2005-40004		Portuguese
	C2005-40005		German
	C2005-40006		Spanish
	C2005-40007		French
	C2005-40008		Italian
	C2005-40009		Dutch
	C2005-40010		Norwegian
	C2005-40011		Polish
	C2005-40012		Swedish
	C2005-40013		Finnish
	C2005-40014		Danish
	C2005-40017		Chinese
	C2005-40018		Taiwanese

Appendix A

Parts Index

Alphabetical Parts Index

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DC Controller PCA, 100-120V, LJ 4P/4MP (Exchange)	C2005-69003	8-7
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DESCRIPTION	PART NUMBER	FIG
DC Controller PCA, 220-240V, LJ 4L/4ML (Exchange)	C2003-69004	8-7
DC Controller PCA, 220-240V, LJ 4L/4ML (New)	RG5-0767-000CN	8-7
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Appendix B

I/O Information

Bi-Tronics Parallel Cable Information

The Bi-Tronics parallel interface is compatible with Centronics parallel interfaces. To take advantage of its enhanced capabilities — such as bi-directional communication between the computer and printer, faster transmission of data, and auto configuration of printer drivers — the customer must have:

- Support in software applications for these features.
- A parallel cable with the correct pin configuration (see below).

Parallel Cable Pin Configuration

For best results, use the C24542D cable, or equivalent. Most existing parallel cables support Bi-Tronics communication, but some might have incompatible pin assignments.

CAUTION Ensure that all power and interface cables on the printer and host computer are properly grounded in compliance with local codes.

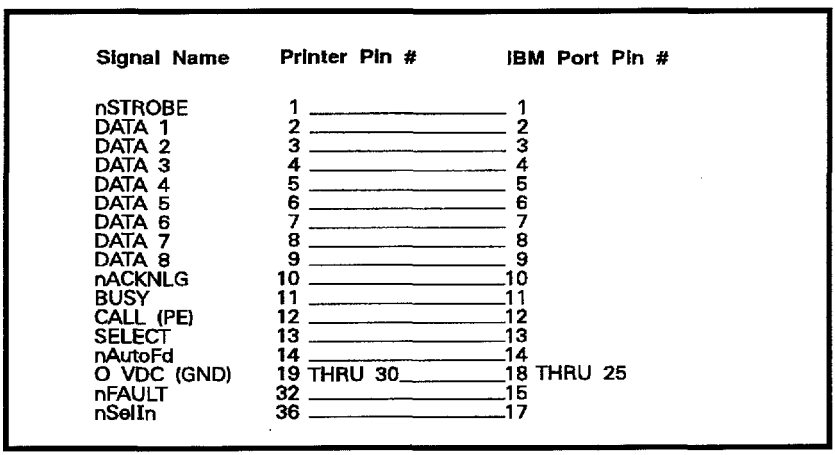

Figure B-1 Parallel Cable Pin Assignments

Serial Cable Pin Configurations (LaserJet 4P/4MP)

The following table diagrams show the cable pinouts for the most common serial configurations.

DB-9 Serial Connection

If connecting to a computer with a 9-pin serial port, use the HP C2932A 9-9 pin M/F serial cable, or equivalent.

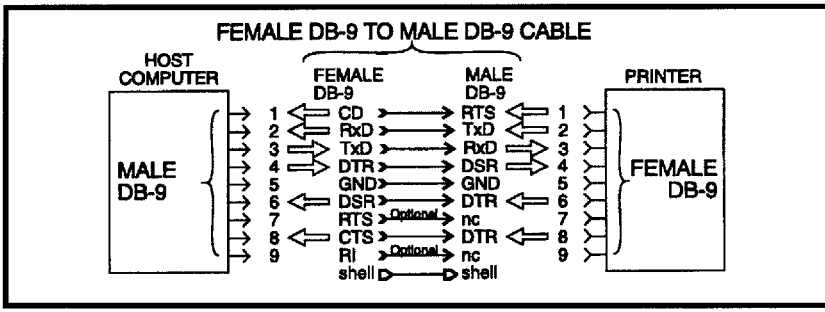

Figure B-2 Serial Pin-Outs DB-9 to DB-9

DB-25 Serial Connection

If connecting to a computer with a 25-pin serial port, use the HP C2933A 9-25 pin M/F serial cable, or equivalent.

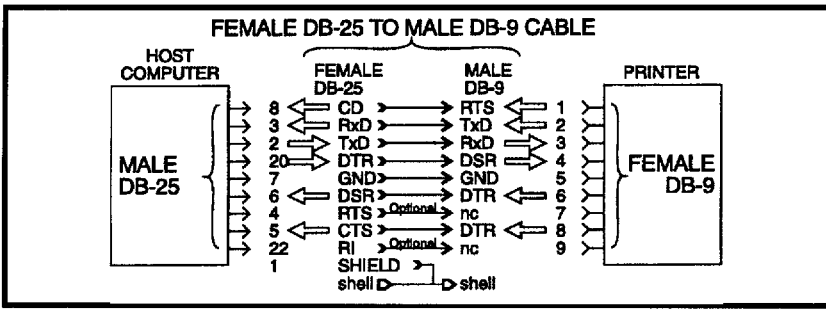

Figure B-3 Serial Pin-Outs DB-25 to DB-9

Connecting to LocalTalk Networks (LaserJet 4ML/ 4MP)

The printer does not come with a LocalTalk network cable. Use a standard LocalTalk network cable and connector kit, such as the HP LocalTalk Network Cable Kit, part number 92215N. You will need one connector kit for each printer on the network, and another for each Macintosh computer on the network.

Connecting to the END of a LocalTalk Network

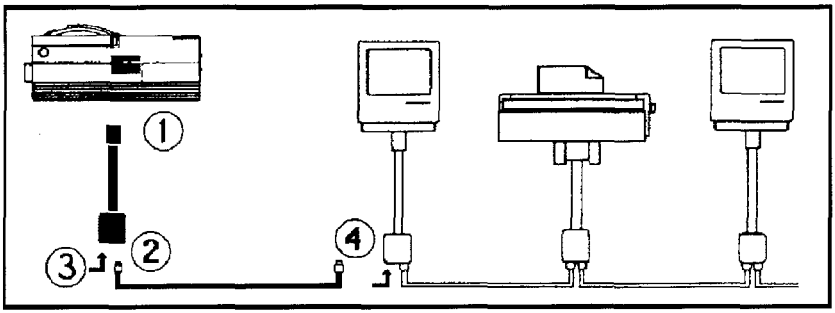

Figure B-4 Connecting to the END of a LocalTalk Network

1. Disconnect the printer from its power source. Insert the connector box cable into the LocalTalk port of the printer.
2. Insert one end of the cable into the new connector box.
3. If the connector box is not self-terminating, insert a terminating resistor into the connector box.
4. Insert the other end of the cable into the last connector box on the network. (Remove the terminating resistor if necessary.)
5. Reconnect the printer to its power source.

Connecting to the MIDDLE of a LocalTalk Network

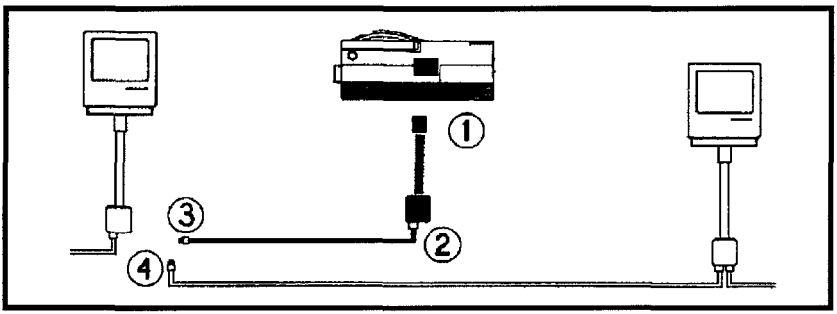

Figure B-5 Connecting to the MIDDLE of a LocalTalk Network

1. Disconnect the printer from its power source. Insert the new connector box cable into the LocalTalk port of your printer.
2. Insert one end of the new cable into the connector box.
3. Place the other end of the new cable next to a connector box on the network.
4. Unplug one cable from the connector box on the network.

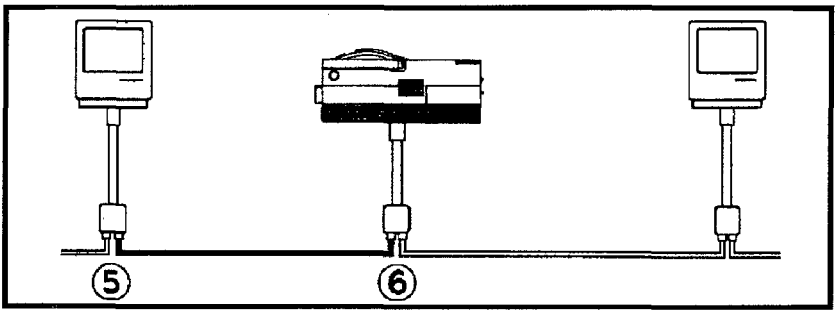

Figure B-6 Connecting to the MIDDLE of a LocalTalk Network (continued)

5. Insert the new cable into the connector box on the network.
6. Insert the cable you removed from the network into the new connector box. Then, reconnect the printer to its power source.

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