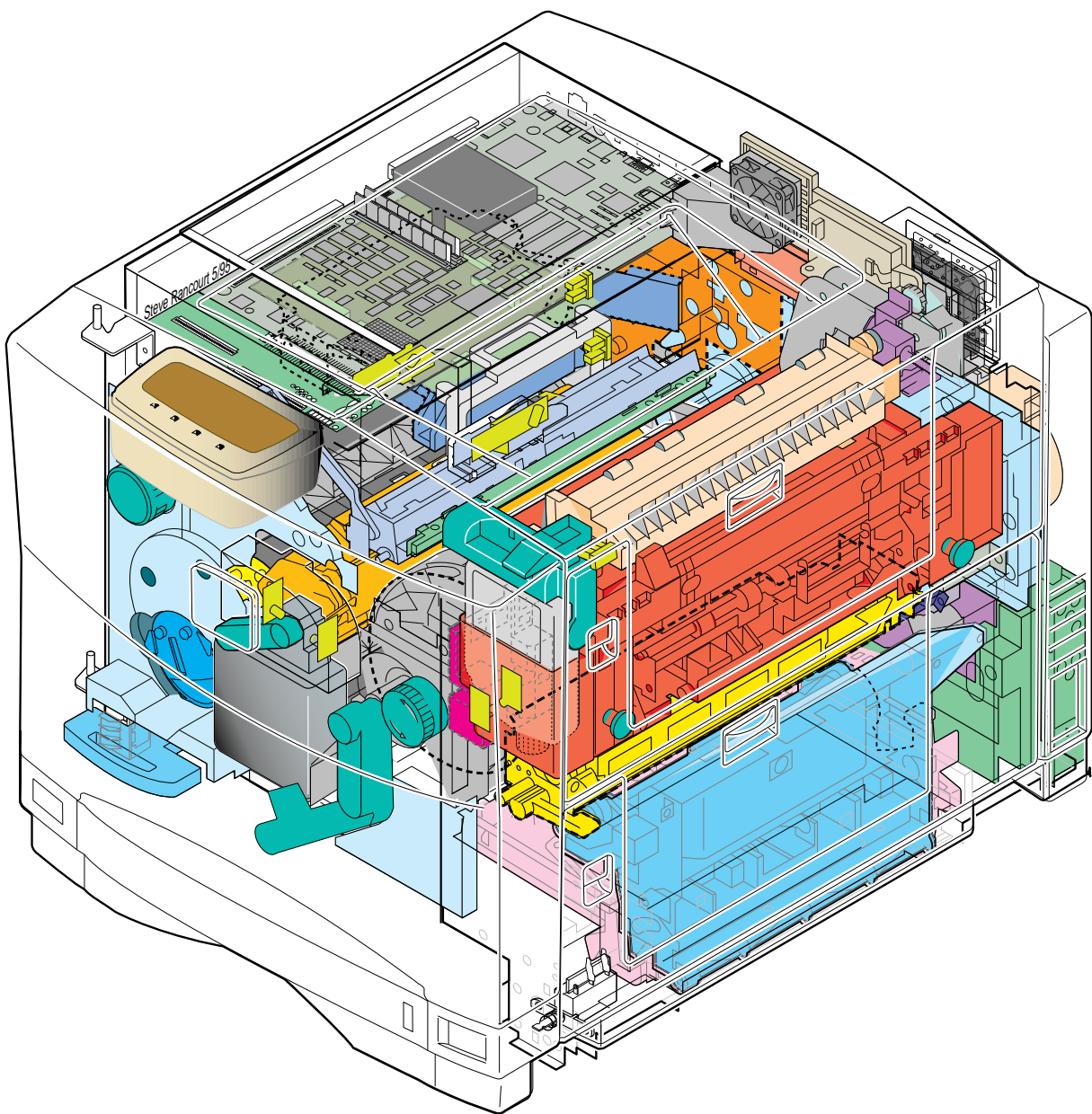


.....

# Color LaserWriter 12/600 PS and 12/660 PS Service Technical Documentation





Thumbnails

Bookmarks

### About Graphics:

Using the magnifier tool enables you to zoom into graphics and see greater detail.



**About Printing:** Always use these numbers when printing pages out of Acrobat. Page numbers that appear on the paper do not reflect their true order within the document.



Could not open the specified file...

If you get this message when trying to launch a QuickTime movie, you may not have enough memory to run MoviePlayer. Try quitting out of other applications.

This error also may occur if you copied files from the CD to a hard drive and have not foldered the files identically to the arrangement of folders on the CD.



## Color LaserWriter

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Color LaserWriter 12/600 PS

Color LaserWriter 12/660 PS



**Color LaserWriter 12/660 PS**

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## Overview

The Color LaserWriter 12/660 PS is an enhanced version of the original Color LaserWriter 12/600 PS. The 12/660 engine and plastics are identical to the original in every respect, and all finished goods and service part numbers apply equally to both printers. The sole differences between the two versions are in the packaging and setup, the ROM and RAM on the I/O controller board, and the driver software.

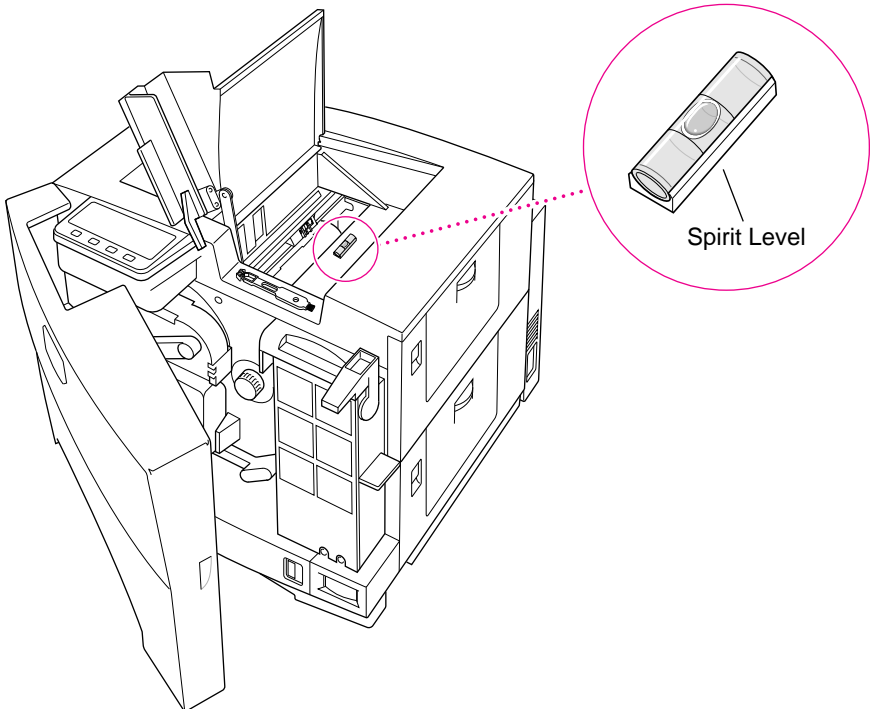
### Packaging and Setup Changes

The Color LaserWriter 12/660 PS requires two extra steps during setup, the leveling of the printer and the removal of oil absorption sheets from the fuser assembly.

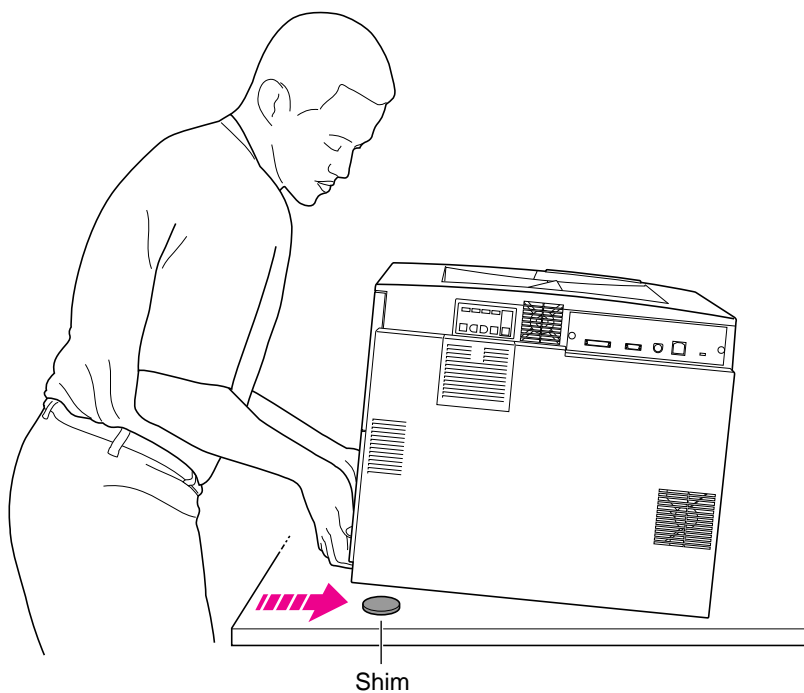
**Note:** The orange flag that identifies the shipping screw has also been enlarged in the new version of the printer.

The leveling procedure helps to alleviate oil overflow problems within the fuser assembly. The level and shim kit that comes with the 12/660 PS is also available separately as P/N 076-0622 for those who would to perform the procedure on the original version of the printer. After removing the packing tape from the outside of the printer, performing the leveling procedure below before proceeding any further.

- 1 Remove the spirit level and the round black rubber shims from their package. Snap the spirit level into its base.
- 2 Open the printer's top access cover and place the spirit level on top of the fuser to level the printer, first from front-to-back, then from side-to-side.

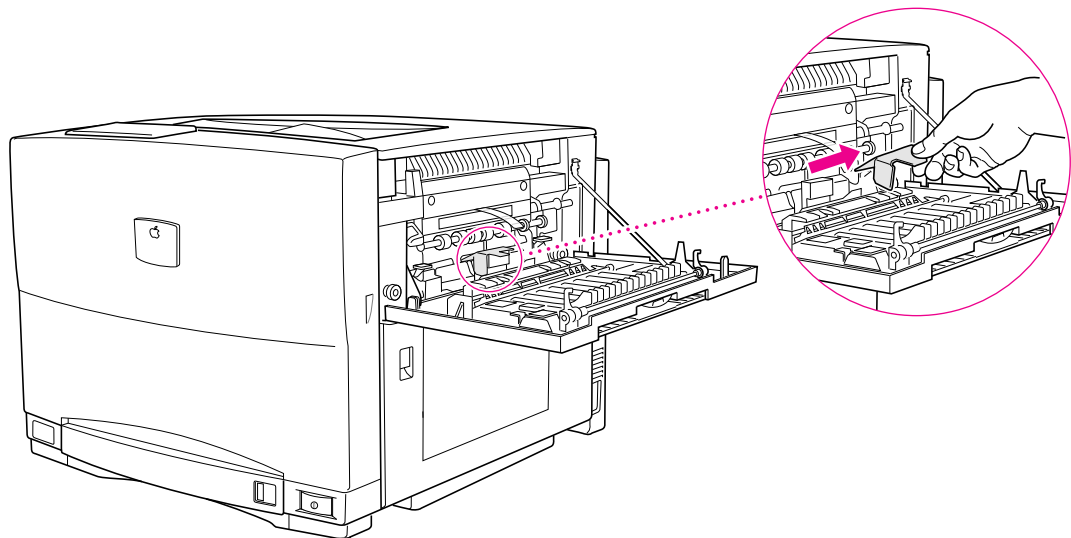


- 3 Place the shims under the printer's feet (as needed) to level the printer.

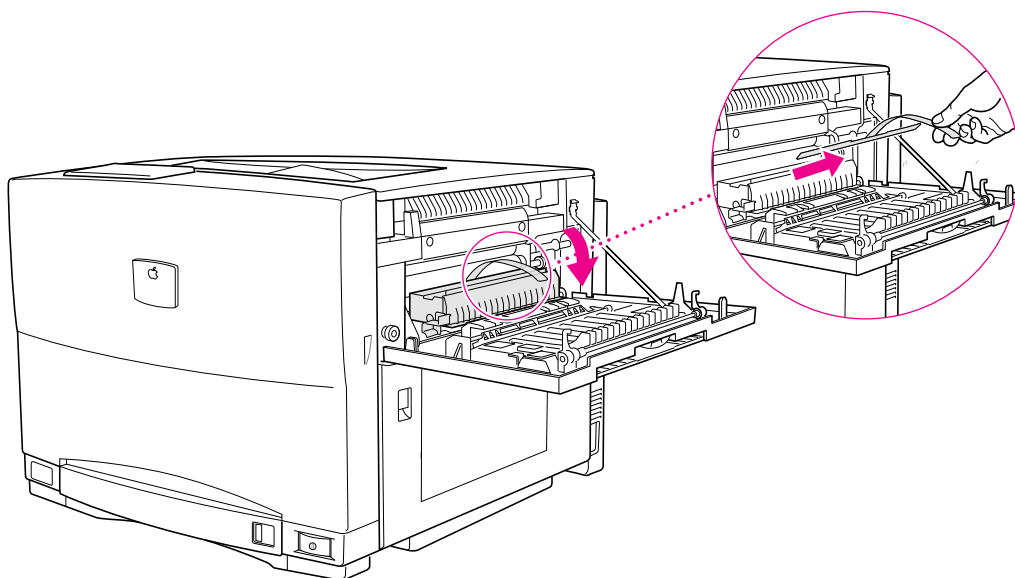


The oil absorption sheets have been installed to eliminate migration of silicon oil during shipping. After leveling the printer, remove the shipping spacers and absorption sheets as described below.

- 1 Open the fuser access door and remove the two orange spacers and the oil absorption sheet from inside.



- 2 Open the fuser assembly and remove the oil absorption sheet from the inside of the fuser assembly.



## I/O Controller Board Changes

The Color LaserWriter 12/660 PS comes standard with 16 MB of DRAM and version 2.0 of ROM. All other characteristics of the board remain the same.

**Note:** Version 2.0 of ROM contains fixes for variety of system and networking bugs that have been reported since the release of the original printer. (I/O controllers with 2.0 ROM will also output new startup and demo pages). If you want to upgrade an existing printer, see “Upgrade Path” later in this chapter.

## Driver Software

The new version of the Color LaserWriter printer does not require a driver upgrade. However, the printer name has changed in ROM. Consequently, with older drivers you must manually select the “LaserWriter Color 12/600 PS” PPD when setting up the new printer in the Chooser.

Alternately, if copy the new “LaserWriter Color 12/660 PS” PPD into the Printer Descriptions folder (path: System Folder:Extensions folder), Chooser setup will be automatic. This PPD can be found on the Service Source CD (path: Service Manuals:Clips:CLW 12/660 PPD).



LaserWriter Color 12/660 PS

## Upgrade Path

You can upgrade a Color LaserWriter 12/600 PS to a Color LaserWriter 12/660 PS by installing version 2.0 ROMs onto the customer's I/O controller board. The version 2.0 ROM upgrade kit is available as P/N 076-0621. The kit contains eight ROM ICs, a user manual addendum, a software installation CD, and upgrade labels.

**Note:** Install new ROM only if the customer's printer is exhibiting one of the problems described below. Install a replacement I/O controller board (P/N 661-0133) only if your troubleshooting has found the board to be defective. All service stock for the I/O controller board will include version 2.0 of ROM.

After installing the new ROM, affix the labels that are provided in the kit as described in the instructions that accompany the ROM upgrade kit.

**Caution:** All but one of the bug fixes contained in version 2.0 of the ROM also appeared in version 1.2. **If your I/O controller board has version 1.2 of ROM, do not upgrade** unless it is specifically for the Windows 95 feature described immediately below. You can identify the ROM version by inspecting the margin text on the startup page.



### Feature added in ROM v2.0

- Plug and play support for Windows 95

Plug and play support means that the user can connect the printer to the system, boot Windows 95, and automatically see the printer name in the "New Hardware Found" dialog box during the installation process. After installation is complete, the Device ID string and related information will be returned whenever the printer is queried for its device id.

### System bugs fixes in ROM v1.2

- System error at address 0x132460

When printing a complex document to the Color LaserWriter 12/600 PS, a page is printed stating "printer restarted due to system error at address 0x132460."

- System error at address @0x33F844

A bug in version 1.0 ROM caused certain complex Adobe Illustrator files to reset the printer and to print a page stating "printer restarted due to system error at address @0x33F844.

- Image stitching problem

When an image has a very fine line running across its body and the line does not seem to belong to the image, that may be a stitching problem. If the same problem occurs when printing to another printer, for example a LaserWriter 16/600 PS, the



problem is likely in the application and the ROM upgrade will not help.

If possible, try printing the problem file to a printer with version 2.0 ROMs. If there is no improvement, then the problem is elsewhere.

- NetWare port number not set properly

When setting the NetWare port number through the Apple Printer Utility, the number did not stick.

- Changing AppleTalk type fails

Changing the AppleTalk “type” on version 1.0 ROMs fails when PAPTest is run through a LocalTalk port. (Unlikely to affect normal user).

- EtherTalkZone and LocalTalkType strings

EtherTalkZone strings and LocalTalkType strings did not take input longer than 31 characters. (Unlikely to affect normal user).

- LocalTalk ports turns off; EtherTalk remains active

In some cases, the LocalTalk port turned off after printing a very large number of PostScript test files to a printer using both EtherTalk & LocalTalk ports, even though the EtherTalk port remained active and could be seen from any host. (Unlikely to affect normal user).

- Specific PostScript Code resets printer

Sending the following PostScript code caused the printer to reset itself (unlikely to affect normal user):

```
[(%disk1%) <</InitializeAction 1>> setdevparams]
```

- PowerPoint v3.0 gradients

Some PowerPoint slides containing complex gradients or patterns would freeze the printer.

- TraySwitch not saved

Enabling the TraySwitch feature on a Color LaserWriter 12/600-J (Kanji version) did not survive power cycles.

- One-byte PostScript filename on printer hard drive

Creating a one-byte long PostScript filename on a printer’s hard disk caused an I/O error. (Unlikely to affect normal user).

- Configuration switch and image data

This issue only affects printing from PC computers using the parallel port. Once the printer’s configuration switch was used,

the default protocol for the parallel port (TBCP) was changed to Normal and not returned back to TBCP, regardless of configuration switch position. In this scenario text documents would print, but documents with images (binary data) would not. The printer's ready light would flash for a while, stop, and then nothing would print.

### **Networking bugs fixes in ROM v1.2**

- NetWare polling

If the printer was in NetWare PServer mode configuration, it would likely stop polling its NetWare print queue after being powered on for more than 24 hours.

- Name lengths increased

The pserver and rprinter name length has been increased to 47 characters maximum.

## Installation Reimbursement Program

Beginning October 21, 1996, Authorized Apple Resellers and institutions are entitled to receive a \$150 reimbursement on the installation(s) of the Color Laserwriter 12/660 PS.

Customers who purchase the printer beginning October 21, 1996 are entitled to have the printer set up and installed in the location of their choice at their site.

### How customers will be informed

A letter will be included with the printer informing customers to contact their Authorized Apple reseller, or Apple directly to perform the installation.

This letter also stipulates special tasks for the customer to perform before a service technician arrives at their location. These tasks include:

- Preparing a suitable location for the printer.
- Having someone available to help the service technician lift the printer from the floor to the table or counter.
- Providing appropriate power, networking connections, and cabling.
- Ensuring that a network administrator (or other knowledgeable person) is available for consultation with the service technician.
- Providing a computer that is configured with the appropriate system software and is functioning on the network.
- Arranging for the storage and disposal of packing materials.

If everything is prepared, the service technician should be able to complete the setup and installation in about 45 minutes.

### Installation procedures

The file “CLW 12/660 Setup.pdf” is the first chapter of the Color LaserWriter 12/660 PS. Read this chapter for the special considerations required when setting up and installing this printer. Click on the icon below to open the file.



CLW 12/660 Setup.pdf

**1**

## **Basics and Theory**

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# **I. General Information**

## Features

Some of the main features of the Color LaserWriter 12/600 PS are as follows:

<b>Print Quality</b>	The printer has a resolution of 600x600 dots per inch, with color Photo-Grade.
<b>Speed</b>	The printer prints up to 12 pages per minute in black, cyan, magenta, or yellow; 3 pages per minute in two or more colors; and 1 transparency per minute.
<b>Multiplatform Support</b>	You can connect the printer to Macintosh, Windows, DOS, and UNIX computers.
<b>Connectivity</b>	The printer offers LocalTalk, Ethernet, and parallel connections.
<b>Automatic Traffic Control</b>	Without any user intervention, the printer can accept jobs simultaneously from AppleTalk, TCP/IP, and NetWare networks and from the parallel port.
<b>Fonts</b>	The printer supports both TrueType and PostScript fonts. The printer has 39 built-in PostScript fonts.
<b>Energy Savings</b>	The printer can automatically lower its power consumption when it's not being used.
<b>Hard Disk Option</b>	You can install an internal hard disk or attach up to six external hard disks to store downloadable fonts.
<b>Paper Handling</b>	You can print up to 350 sheets (250 in the standard paper cassette plus 100 in the multipurpose tray) without changing paper. You can also add a 250-sheet feeder.



## Specifications

### Marking Engine

Canon HX LBP print engine

- 3 ppm in color; 12 ppm in black, cyan, magenta, or yellow; 1 ppm for transparencies
- 600x600 dpi with Color PhotoGrade
- Enhanced 600 dpi grayscale imaging (effective 200-line screen half-tone, 122 gray levels)

### Laser

Semiconductor laser GaAlAs

- Wavelength: 780 nm
- Output power: 1 mW

### Controller

The specifications for the I/O controller board are as follows:

- AMD Am29030 30-MHz microprocessor
- 8 MB of ROM (including 39 Type 1 fonts)
- 12 MB of RAM (16 MB on CLW 12/660); 8 MB soldered + 4 MB (or 8 MB) SIMM (expandable to 40 MB total)
- 128 K parameter SRAM
- SCSI interface for internal/external hard disk(s)
- LocalTalk interface
- High-speed parallel interface (IEEE P1284 ECP, bidirectional)
- Ethernet interface with three protocols: EtherTalk, Novell NetWare IPX (PSERVER or RPRINTER), and TCP/IP (BSD lpd)
- External Ethernet transceivers available for thin coaxial, twisted pair (10Base-T), and thick coaxial (IEEE 802.3 AUI)
- Two-position communication configuration switch
- All ports/protocols simultaneously active
- Color-rendering acceleration
- Data compression/decompression system
- Adobe PostScript Level 2 (version 2014)

### True 600 dpi

The Color LaserWriter 12/600 PS is a true 600 dpi printer because every aspect of its architecture is designed to a 600 dpi specification. In addition, its 8-bit per pixel capability can assign levels of color or gray to each pixel, thereby further enhancing print quality.

**Printer Fonts**

The following fonts are resident in the printer ROM:

- AvantGarde Book, AvantGarde BookOblique, AvantGarde Demi, AvantGarde DemiOblique
- Bookman Demi, Bookman DemiItalic, Bookman Light, Bookman LightItalic
- Courier, Courier Bold, Courier BoldOblique, Courier Oblique
- Helvetica, Helvetica Bold, Helvetica BoldOblique, Helvetica Narrow, Helvetica Narrow Bold, Helvetica Narrow BoldOblique, Helvetica Narrow Oblique, Helvetica Oblique
- Helvetica Condensed, Helvetica Condensed Bold, Helvetica Condensed BoldOblique, Helvetica Condensed Oblique
- NewCentury Schoolbook Bold, NewCentury Schoolbook Bold-Italic, NewCentury Schoolbook Italic, NewCentury Schoolbook Roman
- Palatino Bold, Palatino BoldItalic, Palatino Italic, Palatino Roman
- Symbol
- Times Bold, Times BoldItalic, Times Italic, Times Roman
- Zapf Chancery MediumItalic
- Zapf Dingbats

**Life Expectancies**

Minimum life expectancy for the printer is 5 years or 300,000 pages in black and white or 150,000 color pages, with no monthly page limit. Recommended maintenance interval is 60,000 pages due to wear on fuser and rollers.

Toner Cartridge: 4,000 pages per color when printing documents with average page coverage of 5%.

Photoconductor cartridge: 40,000 pages black and white or 10,000 pages color (for continuous printing); 13,000 pages black and white or 6,500 pages color (printing only single-page documents).

Fuser oil life: 10,000 pages

Fuser assembly life: 60,000 pages

Transfer drum cleaner life: 60,000 pages

Ozone filter life: 60,000 pages

Air filter life: 60,000 pages

Separation Discharge Assembly life: 60,000 pages

Speed	Prints 12 pages per minute in monochrome; 3 pages per minute maximum in color; and 1 page per minute for transparencies. Actual speed depends on the images printed and paper size.
Printing Materials	<p>Uses 16- to 28-pound laser-quality bond (60 to 90 g/m<sup>2</sup>). Most textured and colored stock is accepted but discouraged, as it will adversely affect color print quality.</p> <p>The paper used should not scorch, melt, transfer material, or release hazardous emissions when heated to 200° C (392° F) for 0.1 seconds.</p>
Transparencies	Use only Apple Color LaserWriter 12/600 PS Transparencies A4 or Letter.
Paper Sizes and Capacity	Supports U.S. letter and A4 in the standard paper cassette. The paper cassette holds 250 sheets of 20-pound (75 g/m <sup>2</sup> ) paper. The multipurpose tray can hold up to 100 sheets of standard U.S. letter paper, and other paper sizes up to U.S. legal. Optional 250-sheet universal cassettes are available that support letter, A4, B5, and U.S. legal paper sizes. Cassettes are compatible with both the printer and the optional sheet feeder.
Suggested Paper Brands	<p>Apple has tested the following papers and found them to be acceptable.</p> <ul style="list-style-type: none"><li>• Aussydat-lay (A4, France) 100 g/m<sup>2</sup></li><li>• Boise Cascade Laser, 20 and 24 pound</li><li>• Classic Crest, 24 pound</li><li>• Hammermill Laser Print, 24 pound</li><li>• Legacy Laser Paper, 24 pound</li><li>• Nekoosa Laser 1000, 24 pound</li><li>• Neusiedler (A4, Austria) 100 g/m<sup>2</sup></li><li>• Xerox 4024 (LTR and A4), 20, 24, and 28 pound</li><li>• Nekoosa Laser 1000, 24 pound</li></ul> <p><b>Note:</b> Recycled paper is not recommended. It tends to produce more paper dust, degrading image quality and necessitating more frequent replacement of the fuser assembly.</p>

Dimensions	Height: 18 in. (46 cm) Width: 21 in. (54 cm) Depth: 23 in. (58 cm)
Weight	Approximately 110 lb. (50 kg) for the printer body only
Environmental Conditions	During printer operation: Temperature 50° to 86° F (10° to 30° C) and humidity 20 to 80 percent RH noncondensing (for optimum print quality, operate at 35 to 70 percent RH)  In storage (both toner cartridges and printer): Temperature –4° to 104° F (–20° to 40° C) and humidity 10 to 95 percent RH noncondensing
Acoustic Output	Standby, less than 45 dB Printing, less than 55 dB
Wait Times	<ul style="list-style-type: none"><li>• Either 120 or 240 V, 3.5 minutes maximum</li><li>• Either 100 or 220 V, 4.5 minutes maximum</li></ul>
Voltage Requirements	100 to 120 V (50/60 Hz) or 220 to 240 V (50 Hz), voltage tolerance plus or minus 10%
Power Consumption	Energy-saving mode <ul style="list-style-type: none"><li>• Approximately 42 W (meets EPA Energy Star)</li></ul> Standby average <ul style="list-style-type: none"><li>• 100/120 V, approximately 215 W</li><li>• 220/240 V, approximately 238 W</li></ul> Operating average <ul style="list-style-type: none"><li>• 100/120 V, approximately 535 W</li><li>• 220/240 V, approximately 524 W</li></ul> Maximum power consumption <ul style="list-style-type: none"><li>• 100/120 V, approximately 1.1 KW</li><li>• 220/240 V, approximately 1.0 KW</li></ul>

## Safety Information

### Laser Safety

The invisible laser beam irradiated within the laser/scanner assembly can be harmful if it comes into contact with your eyes. Consequently, never disassemble the laser/scanner assembly. A cautionary label has been affixed to the top of the laser/scanner assembly.

**Note:** The laser/scanner assembly cannot be adjusted in the field, nor are any of its components available from Apple.



Laser Safety Label

### Toner Safety

If you get toner on your skin or clothes, remove as much as possible with dry tissue and then wash with cold water. Do not let toner come into contact with vinyl material.

### Ozone Safety

The charging roller and separation discharge assembly generate very small amounts of ozone gas when the printer is operating. The printer meets the Underwriters Laboratory (UL) ozone emission standard.

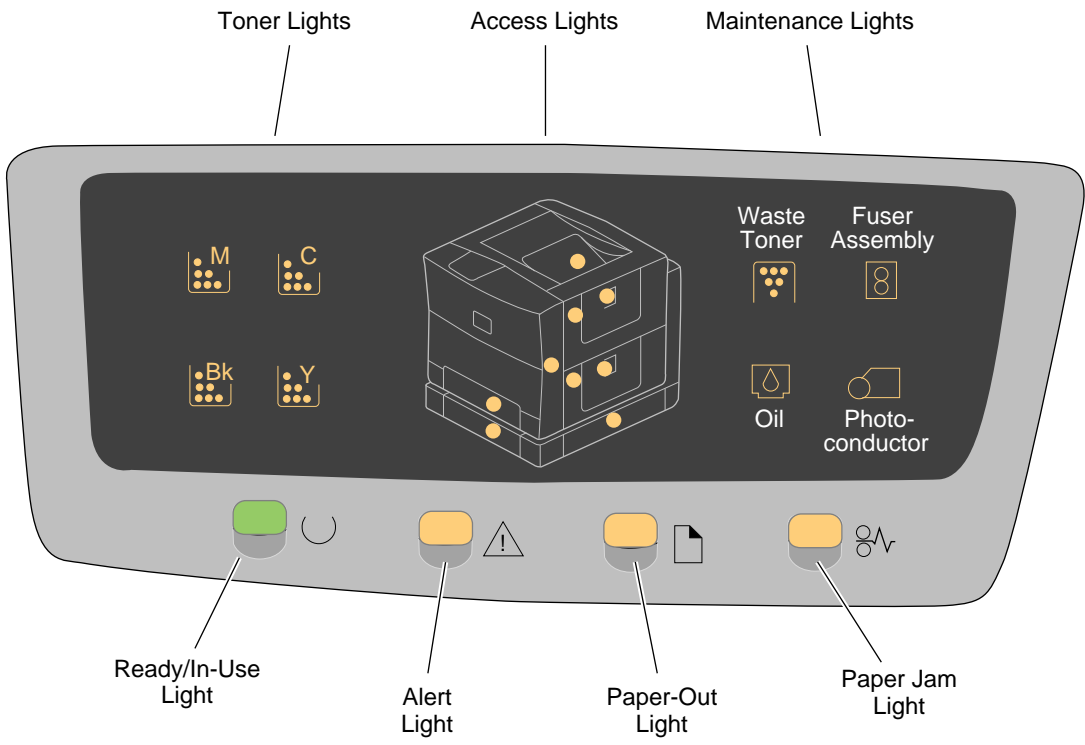
## Status Panel














































































































### Outline

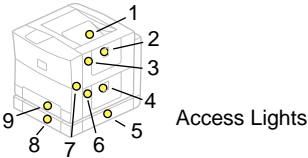
The Color LaserWriter 12/600 PS status panel consists of 4 primary and 17 secondary lights. The primary lights, arranged horizontally along the bottom of the panel, are similar to those on the LED panels on many of Apple's previous printers.



During normal operation, primary lights report general readiness states for consumables, paper supply, and paper feed. Secondary lights report on specific consumables and highlight locations of a consumable, paper jam, or paper problems. The QuickTime movie to the left shows the normal operational behavior of the status panel when the printer starts up. See Chapter 2 for information on the Power-On Self Test (POST).



Status Panel Lights				
⚡ = Flashing				
These are the possible arrays that customers can see during normal printer operation.				
   			Description	Printer Stops
   			Warming Up /Processing	
   			Printer Ready	
    			Low Magenta	No
    			Low Cyan	No
    			Low Yellow	No
    			Low Black	No
    			Low Fuser Assembly	500 pages later
    			Low Fuser Oil	50 pages later
    			Photoconductor Warning	No
     			No Magenta Cartridge	Yes
     			No Cyan Cartridge	Yes
     			No Yellow Cartridge	Yes
     			No Black Cartridge	Yes
     			Toner Disposal Box Full	Yes
     			No Fuser Assembly	Yes
     			No Fuser Oil	Yes
     			No Photoconductor Cartridge	Yes
     			Door Open	Yes
   			(See "POST Code Matrix" in Chapter 2)	Yes
   				

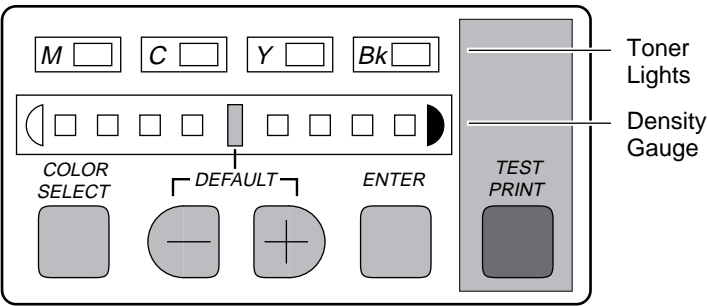


## Density Control Panel

The density control panel on the rear of the printer can be used to generate a service test page and to set three distinct types of adjustments. Some adjustment settings are persistent (i.e., they will remain in effect after a printer restart), and some are nonpersistent (i.e., they will default to factory setting after a printer restart).

### Panel Layout

In addition to the test print button, the density control panel has four toner-indicator lights along the top, an LED density gauge in the middle, and four input buttons along the bottom of the panel.



- **TEST PRINT button:** Press this button to generate a service test page.

**Important:** If the printer is in energy-saving mode, you must print to the printer or restart the printer before you can run a service test page.

- **ENTER button:** Engages the currently selected value.

**Note:** The next four items are labelled on the panel according to their density adjustment functions. During other adjustments, ignore the labels and the functions described below.

- **COLOR SELECT button:** Selects the color whose density you want to adjust.
- **Density gauge:** Indicates the currently selected density value for the selected color, light density to the left, dark to the right.

**Note:** During printer-ready state, you can tell if the density settings are not at the factory default by looking at the center density gauge LED above the word **DEFAULT**. If this LED is off, then the density settings have been changed from the default.

- 5 **Plus/minus (+/-) buttons:** Advance the density gauge setting.
- 6 **Toner Lights:** An illuminated toner light indicates the color that is being adjusted.



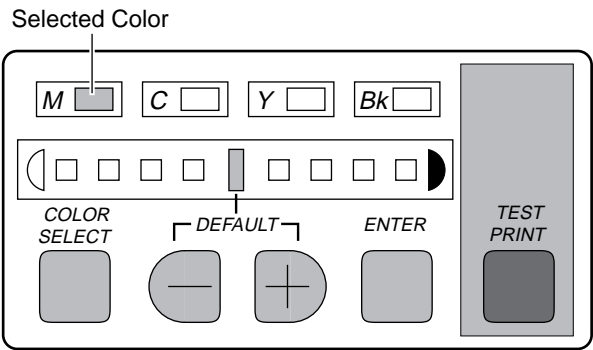
## Density Adjustments

This feature is offered for customers who have multiple Color LaserWriter 12/600 PS printers in a single location and need to adjust one printer to match the output of another.

**Important:** The range of settings is limited. Use this feature only if you have prior experience in four-color density adjustments.

The printer needs to be switched on and in a ready state to make density adjustments. Density adjustments are persistent. To adjust the density,

- 1 Press the COLOR SELECT button as many times as necessary until the desired toner light illuminates.



- 2 Press the plus or minus button to change the setting for that color. The density gauge LED will light whenever the selected setting differs from the previously entered setting.
- 3 Repeat steps 1 and 2 if you want to adjust other colors.
- 4 Press the ENTER button to engage the settings.

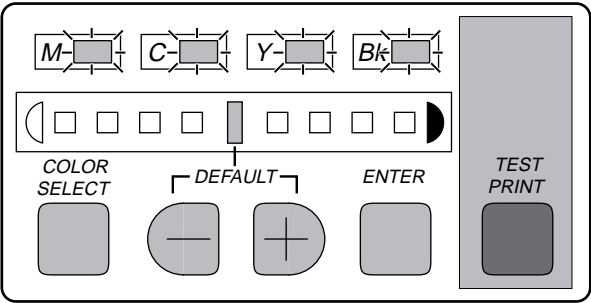
**Note:** If you want to quickly return the printer to its factory defaults, press and hold both the plus and minus buttons for at least five seconds.

Test Page  
Pattern  
Selection

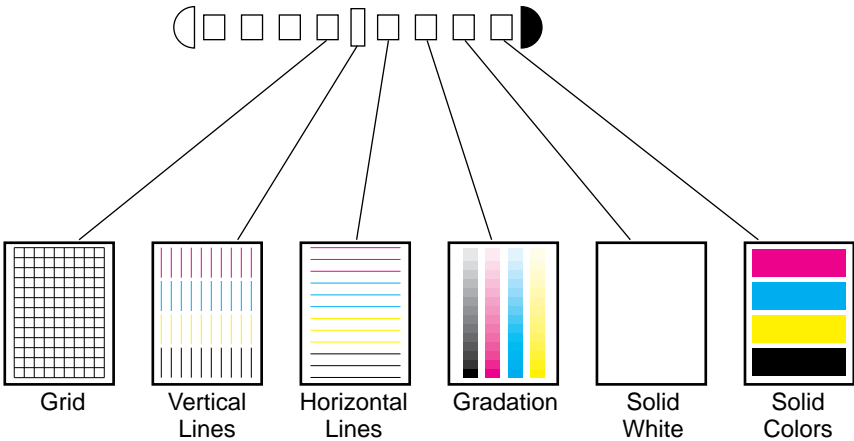
This feature allows you to select one of six test page patterns based upon which one would best confirm a print quality issue.

Test pattern selection is nonpersistent. After restart, the test page reverts to the vertical line pattern. To select a pattern,

- 1 Hold down the COLOR SELECT button and press the ENTER button eight times. The four toner lights will flash to indicate that you are in the test pattern selection mode.



- 2 Using the plus or minus buttons, advance the density gauge to illuminate the LED corresponding to the desired pattern. The density gauge will flash when the selected setting differs from the previously entered setting. Only LEDs 4 through 9 on the density gauge correspond to available patterns.



- 3 Press the ENTER button to engage the setting. If you make no further adjustments, the panel will exit from the test pattern selection mode in 30 seconds.

Usage Tips

Each pattern will inherently reveal a different type of defect. For example, color registration problems are revealed best by the grid pattern, while dirty rollers are revealed by printing a solid white page.

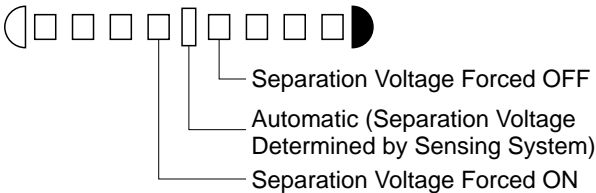
**Note:** By measuring the distance between repeating print defects, you can isolate the problem to a specific roller within the printer. See “Roller Diameters” in Chapter 2.

Separation  
Voltage  
Designation

This feature allows you to override the printer sensing system and force the separation discharge assembly on or off. Forcing-on is intended as a fail-safe in low temperature/low humidity conditions where paper is not properly separating from the transfer drum, and as a countermeasure in some image-offset problems. Forcing-off is a countermeasure against toner displacement.

The separation voltage designation is nonpersistent. After restart, the designation will revert to automatic. To designate the separation voltage,

- 1 Hold down the COLOR SELECT button and press the ENTER button three times. The yellow and black toner lights will flash to indicate that you are in the separation voltage designation mode.
- 2 Using the plus or minus buttons, advance the density gauge to illuminate the LED corresponding to the desired designation. The density gauge will flash whenever the selected setting differs from the previously entered setting. Only LEDs 4, 5, and 6 on the density gauge correspond to available designations.

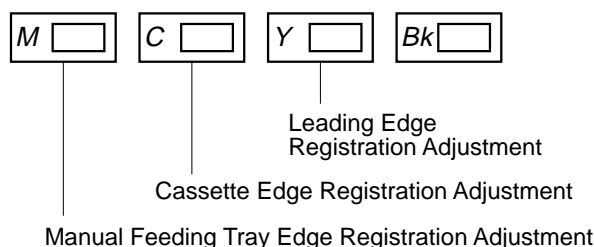


- 3 Press the ENTER button to engage the setting.

## Registration Adjustments

This feature allows you to adjust the placement of the image area on the page. Registration adjustments require that the printer be placed into a service adjustment mode. Consequently, these adjustments are not designed to be available to end users. Registration adjustments are persistent. To adjust the registration,

- 1 Turn off the printer. Press and hold the TEST PRINT button and switch the printer back on. The normal startup sounds will not occur. Continue to hold the TEST PRINT button down for 25 seconds, at which time you will notice a slight slowing of the controller fan.
- 2 Press the COLOR SELECT button once. The black toner light will flash to indicate that you are in the service adjustment mode. In addition, one of the other toner lights will illuminate steadily. Keep pressing the COLOR SELECT button until you come to the setting that you want.

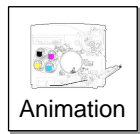


- 3 Using the plus or minus buttons, advance the density gauge to illuminate the LED corresponding to the desired adjustment value. For leading edge registration adjustment, each step in the gauge is equal to .012 inch (.3 mm). For the other two adjustments, each step in the gauge is equal to .017 inch (.425 mm).
- 4 Press the ENTER button to engage the setting.

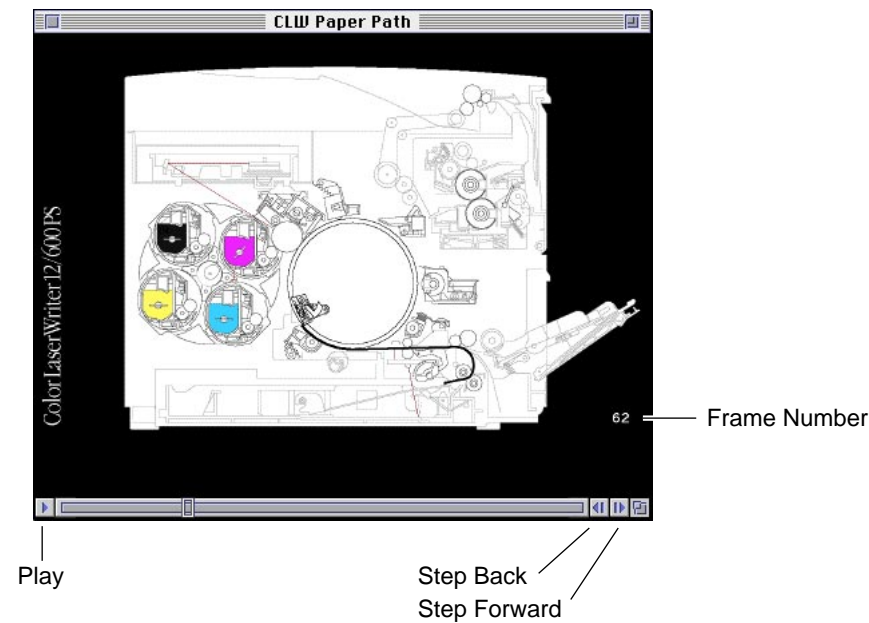
**Note:** If you want to quickly return the printer to its factory defaults, press and hold both the plus and minus buttons for at least five seconds.

## **II. Basic Operation**

## Paper Path Animation



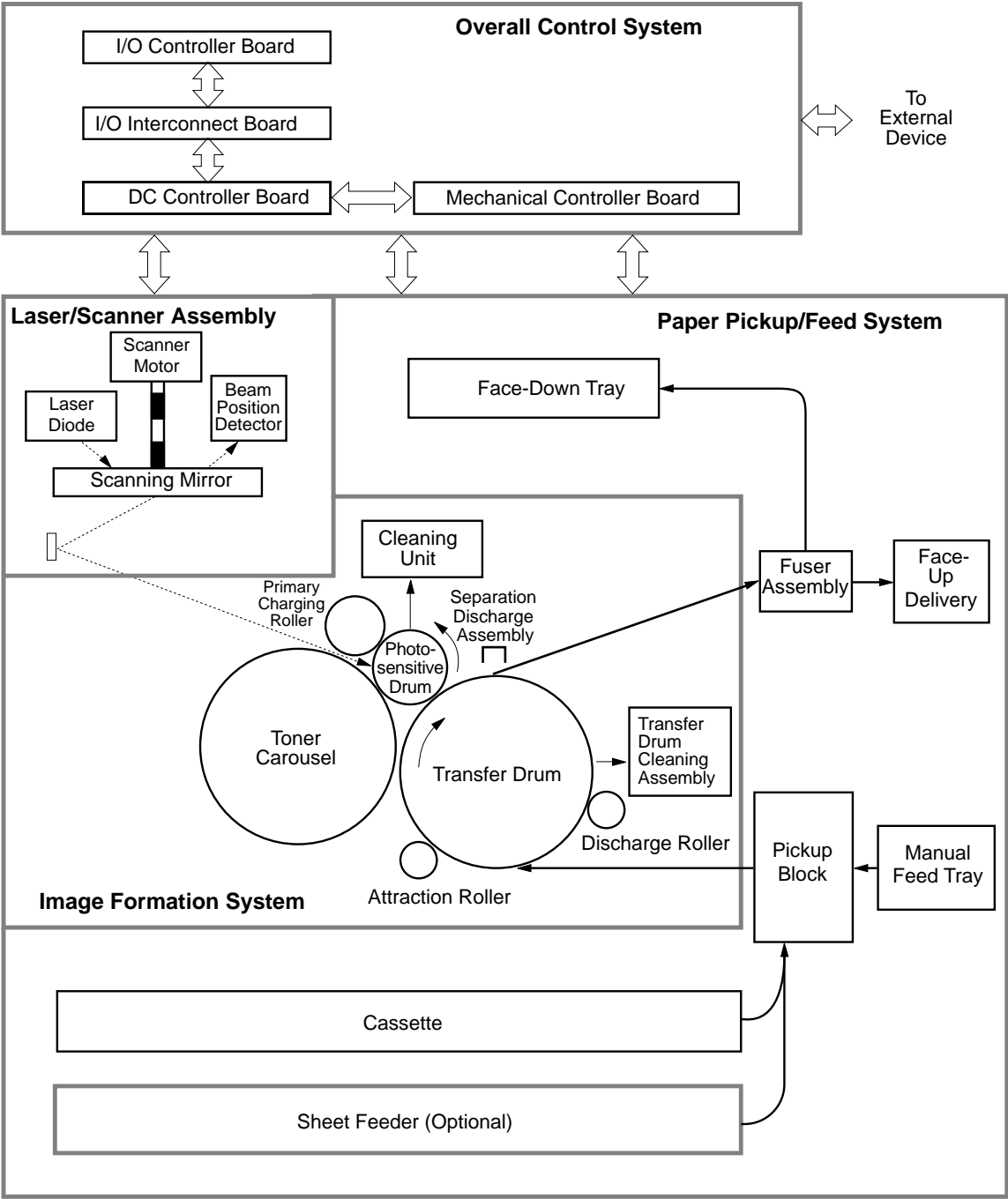
The icon to the left appears at key points throughout this manual. Clicking it launches a QuickTime animation called “CLW Paper Path.” This animation shows one complete print cycle through the Color LaserWriter 12/600 PS, starting at the point where the final sheet of paper is picked up from the cassette, and ending with the delivery of the paper at the top of the printer.



The animation is very detailed and moves very quickly. By using the “Step Back” and “Step Forward” buttons at the bottom right of the frame, you can step frame-by-frame through the animation. Whenever applicable, specific frame numbers that best illustrate a given topic are called out.

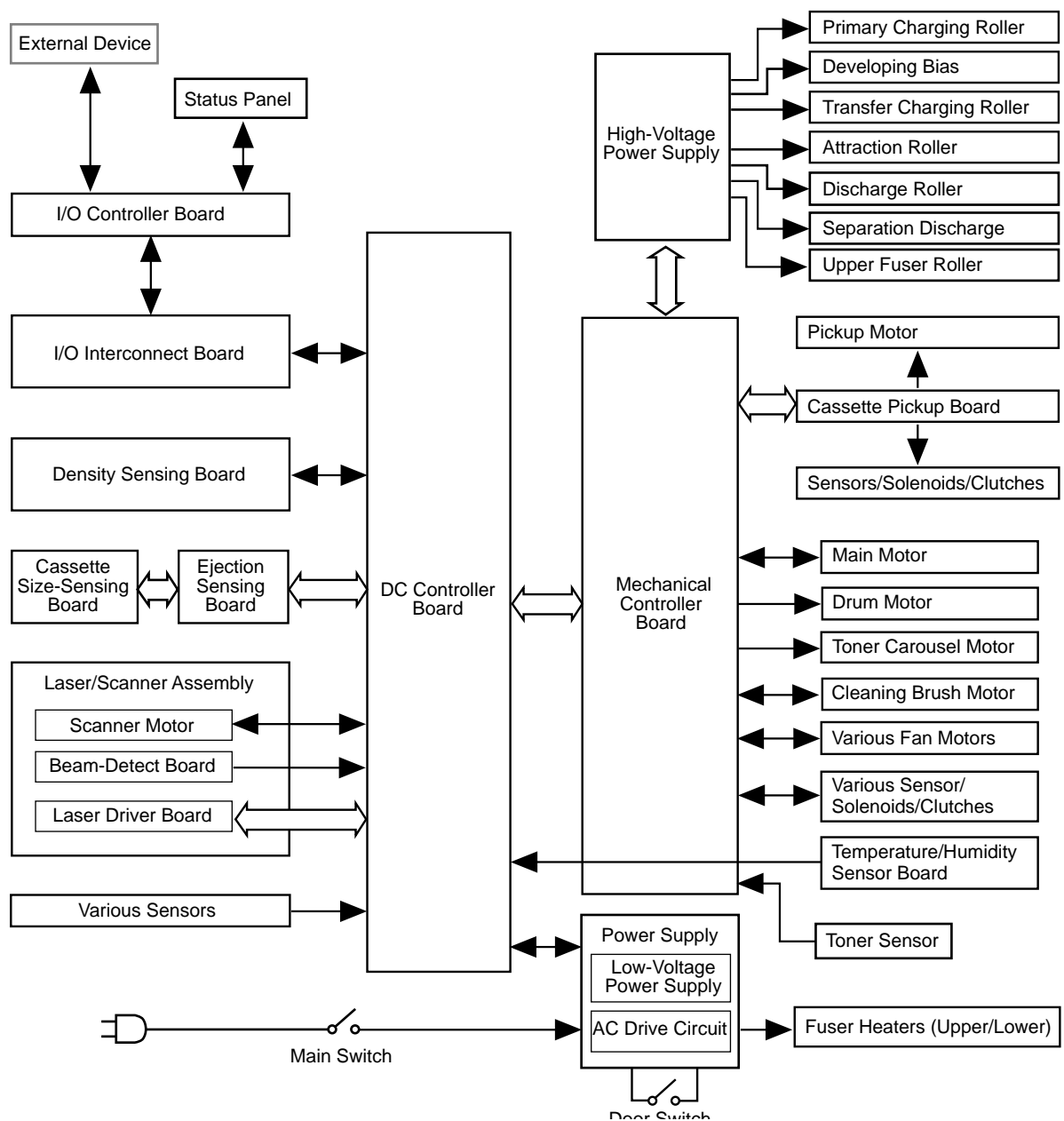
Functions

Printer functions can be divided into four systems: the overall control system, the image formation system, the laser/scanner system, and the paper pickup/feed system.



Outline of Electrical System

The operation sequence for the printer is controlled by the microcomputers on the DC controller and the mechanical controller boards. When the printer is turned on and enters the standby state, the microcomputer on the DC controller sends signals for driving the laser diode, fuser heaters, and other loads in response to the print signal entered from the I/O controller board. Simultaneously, the microcomputer on the DC controller sends the print sequence command to the microcomputer on the mechanical controller. Subsequently, the latter microcomputer outputs the signals for driving various loads, including the high-voltage power supply, motors, and solenoids.





## Outline of Major Circuit Boards

This section describes the functions of the DC controller board and the mechanical controller board. See “Circuit Boards” in the Parts chapter for additional information.

### DC Controller Board

This board controls the printer. When the /PRNT signal is received from the I/O controller, the DC controller sends the print sequence command to the mechanical controller, which then starts controlling various loads. The DC controller also provides

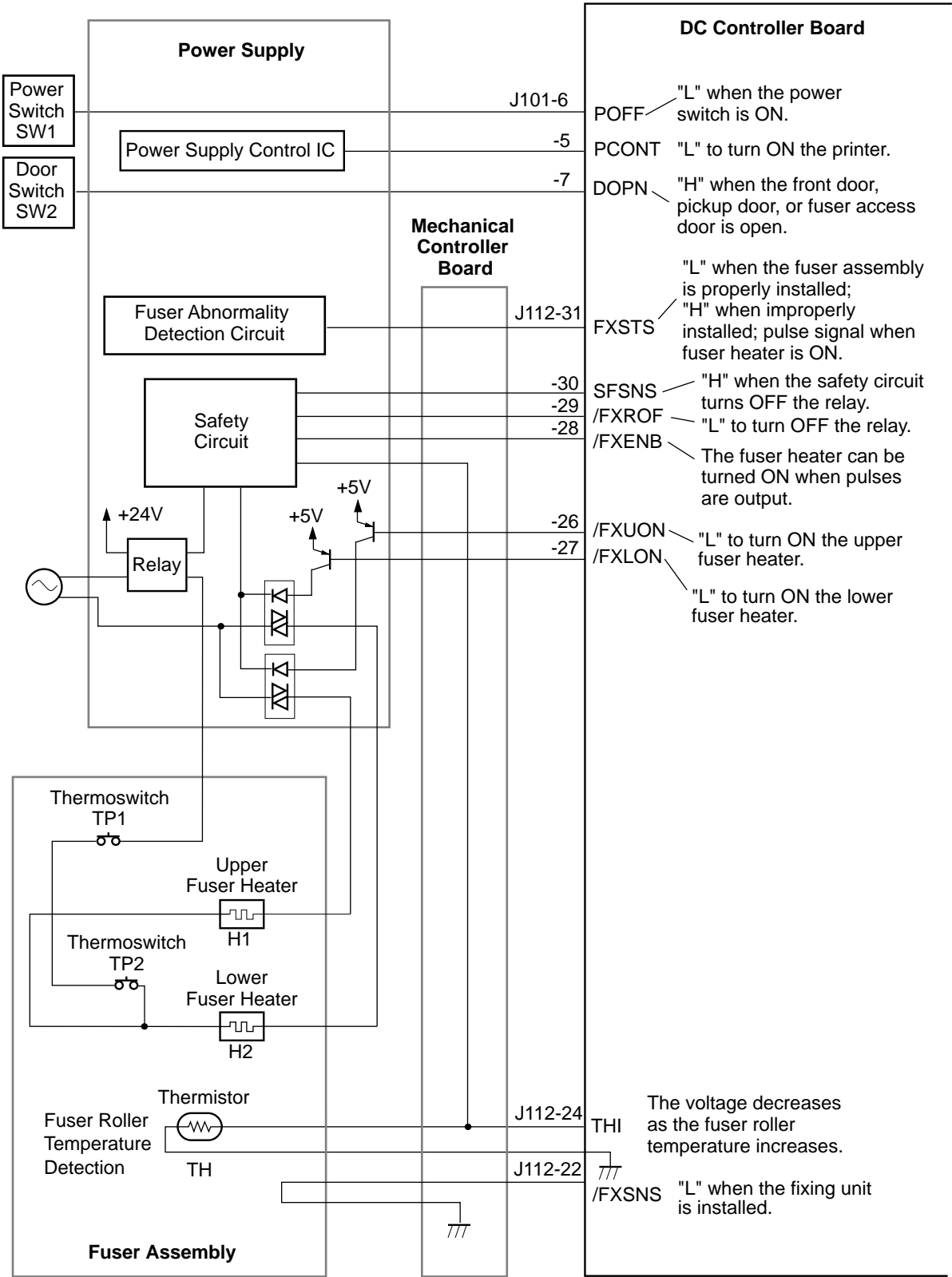
- Laser/scanner control
- Image stabilization control
- Fuser temperature control
- Power-off time measurement
- Various detection functions
- I/O interface control

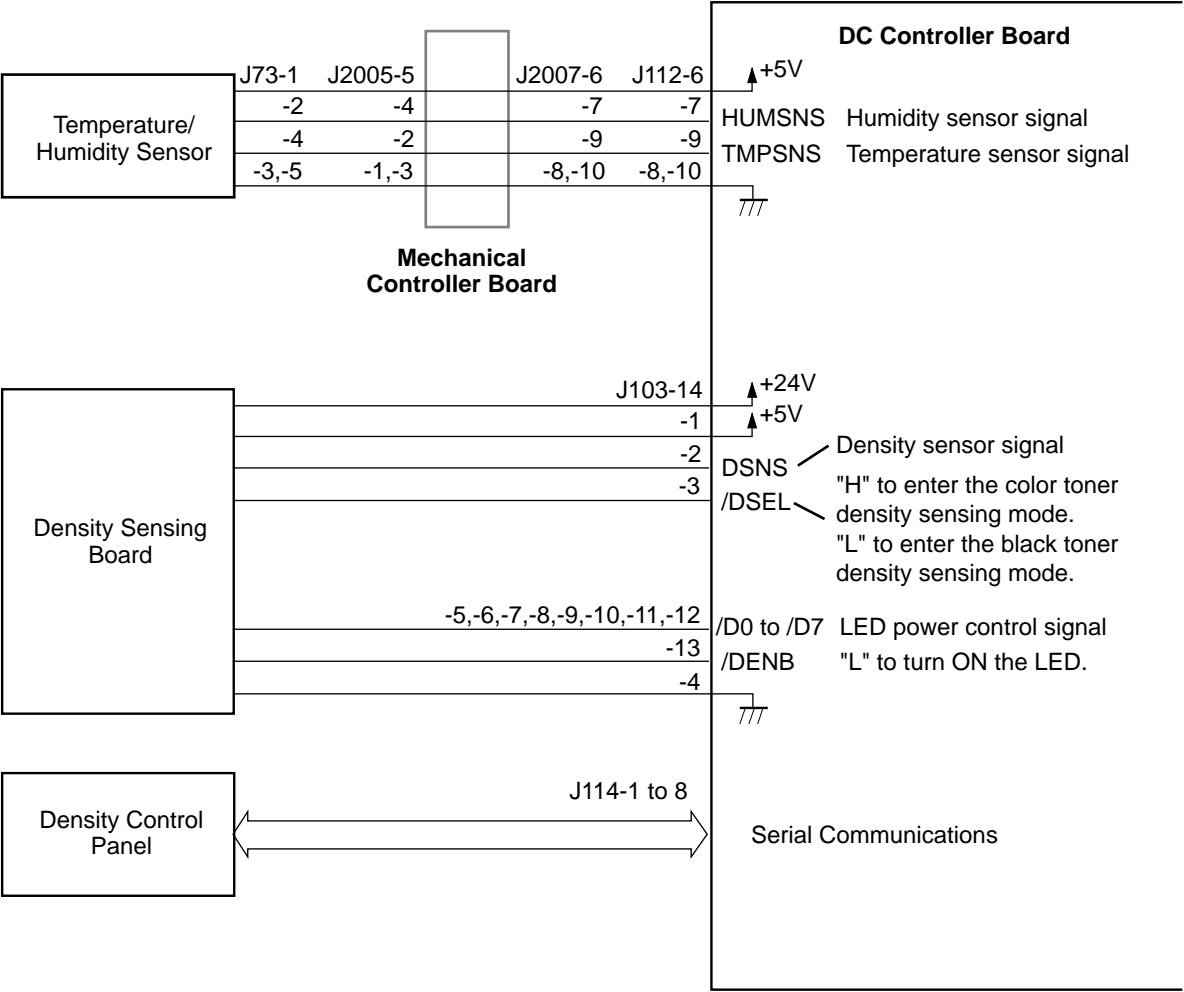
### Mechanical Controller Board

This board controls various loads in response to signals from the DC controller board. The mechanical controller returns the status signals to the DC controller. The mechanical controller controls the cassette pickup board, the high-voltage power supply, and the sheet feeder controller board via its serial communications. The mechanical controller also provides

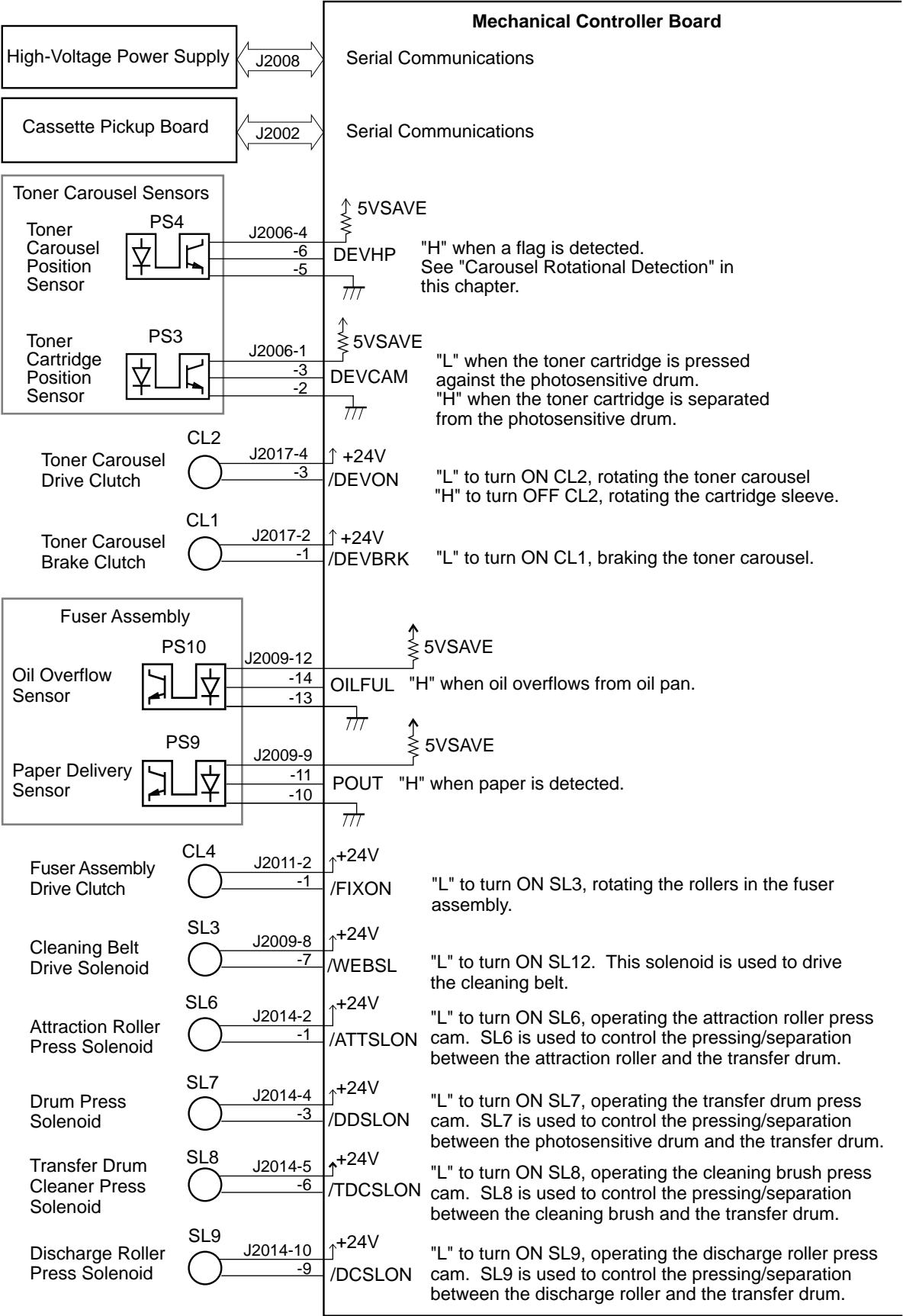
- Drive of various motors and fan motors
- Control of the toner carousel
- Control of the fuser assembly
- Control of the transfer drum and its peripheral assemblies
- Control of the cassette pickup board, the high-voltage power supply, and the sheet feeder controller board
- Toner stirring function, toner-low detection, and toner cartridge detection
- Photosensitive drum life detection
- Waste toner collection system control
- Energy-saving mode control

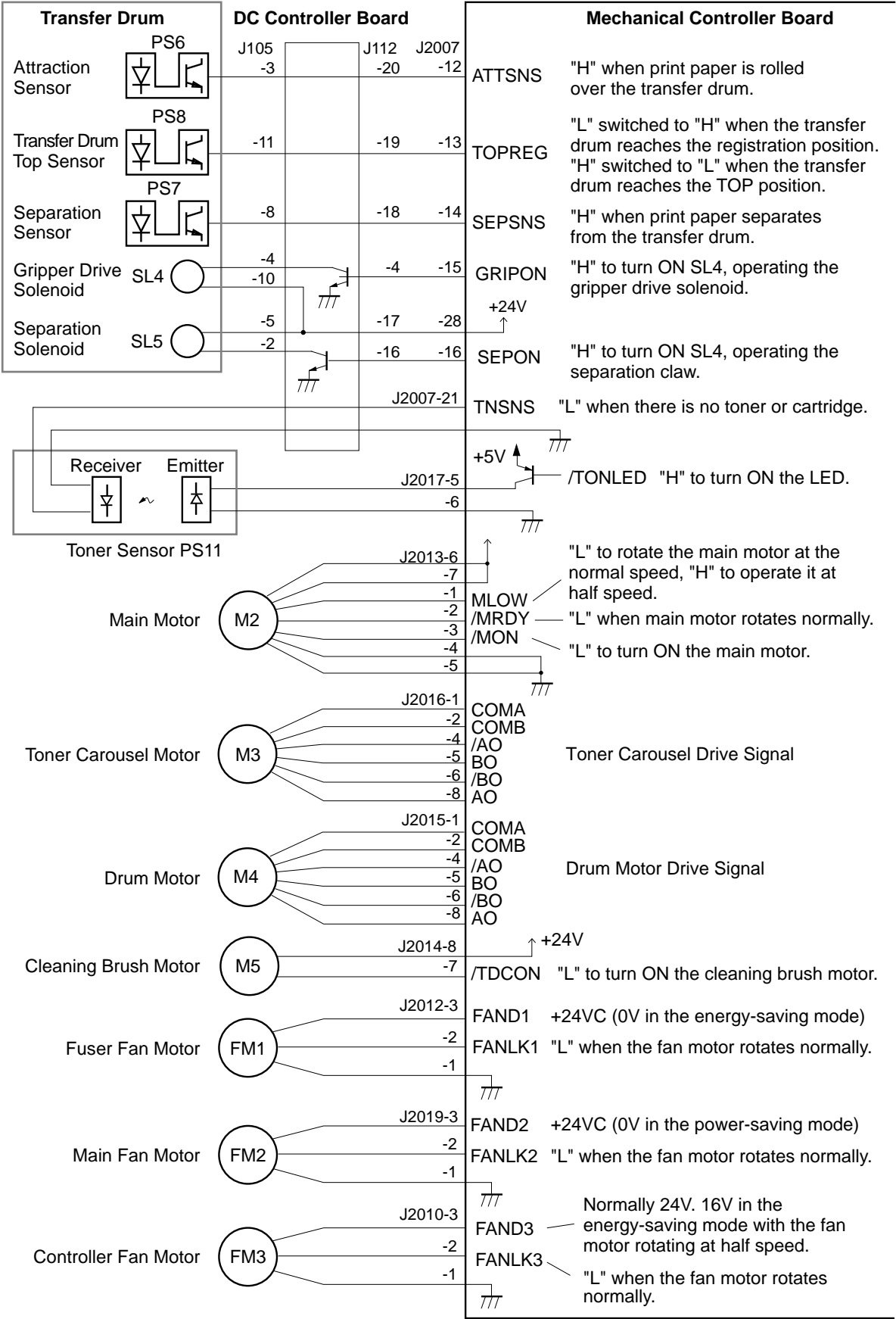
Laser/Scanner Assembly				DC Controller Board			
<div>Laser Control Board</div> <div>Laser Diode</div>		J111-23		/DOENB	"L" when video data can be written.		
		-22		/LSON	"L" to switch ON the laser diode forcibly.		
		-17		NHD	Reset signal		
		-9		SCK1	Clock signal		
		-1,-3,-4,-5, -6,-7,-13,15		M1 to M8	PWM mode-setting signal		
		-11					
			J110-7	LLCNT	Analog signals are output to control the laser power.		
<div>Beam-Detect Board</div>	J451-1	J102-4	+5V				
	-2	-3	/BDI	"L" when the BD signal is input.			
	-3	-2					
<div>Scanner Motor</div>	J701-1,-2	J102-10,-11	+24V				
	-6	-6	SCNCLK	Reference clock signal			
	-4	-8	/SCNON	"L" to drive the scanner motor.			
	-3	-9	/SCNRDY	"L" when the scanner motor is rotating normally.			
	-5,-7	-5,-7					
Oil-Low Sensor PS13	J631-3	J106-6	OILSNS	"H" when oil runs out.			
<div>Cleaning Belt Sensor PS5</div>	J61-3	J106-1	LEDON	"L" when the power-saving mode is set.			
	-1	-3	WEBSNS	"H" when the cleaning belt has run out.			
<div>Transfer Drum Top Sensor PS8</div>	J41F-1	J105-13	+5V				
	-3	-11	TOPREG	"H" switched to "L" when the TOP position of the transfer drum is detected. "L" switched to "H" when the registration position is detected.			
<div>Waste Toner Sensor PS12</div>	J631-3	J107-1	LEDON	"L" when the power-saving mode is set.			
	-1	-3	TNFUL	"H" when the waste toner is full.			
<div>Cassette Size-Sensing Switch</div> <div>Ejection Sensing Switch</div>	CSW3	J312-1	J1602-4	J1601-1	J107-7	/CSIZE3	<div>SW1601</div> <div>The cassette size and the pulling operation for the ejector are detected.</div>
	CSW2	-2	-3	-2	-6	/CSIZE2	
	CSW1	-3	-2	-3	-5	/CSIZE1	
		-4	-1	-4	-4		





Mechanical Controller Board Input/Output Signals





## Outline of Drive System

The printer has six motors: the pickup motor, main motor, drum motor, toner carousel motor, cleaning brush motor, and scanner motor. See “Motors/Fans/Heaters” in the Parts chapter for additional information.

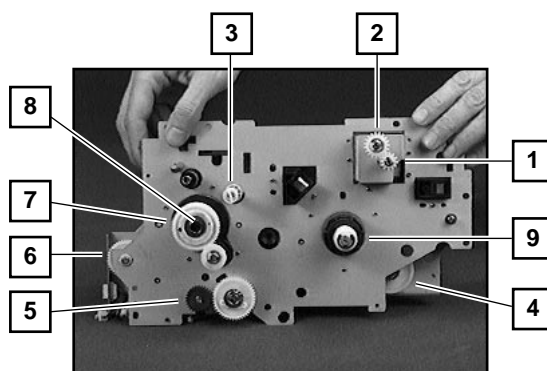
### Pickup Motor (M1)

The pickup motor is a two-phase stepping motor in the paper pickup block and is controlled by the cassette pickup board. The pickup motor provides mechanical drive to the following parts:

- Cassette pickup roller
- Separation roller
- Registration roller
- Manual feed pickup roller
- Manual feed paper lifting cam
- Feed rollers 1 and 2

### About the Printer Drive Assembly

The printer drive assembly houses three separate drive trains for main motor M2, toner carousel motor M3, and drum motor M4. Their delivery points and destinations are as shown:



#### Main motor (M2) drive train

- 1 Fuser assembly
- 2 Paper delivery assembly (via the delivery drive assembly)
- 3 Waste toner screw
- 4 Transfer drum peripherals

#### Toner carousel motor (M3) drive train

- 5 Toner carousel rotation
- 6 Toner cartridge press (via cartridge press drive gear)
- 7 Developing cylinder rotation (outer gear)

#### Drum motor (M4) drive train

- 8 Photosensitive drum (coupling at the center of the gear)
- 9 Transfer drum

**Main Motor  
(M2)**

The main motor is a DC brushless motor. It is controlled by the CPU on the mechanical controller board and provides mechanical drive to the following parts:

- Fuser assembly
  - Upper and lower fuser rollers
  - Fuser delivery roller
  - Oil-applying roller
  - Oil pump
- Paper delivery assembly
- Transfer drum peripherals
  - Attraction roller press cam
  - Transfer drum press cam
  - Cleaning brush press cam
  - Discharge roller press cam
- Waste toner screw inside the photoconductor cartridge

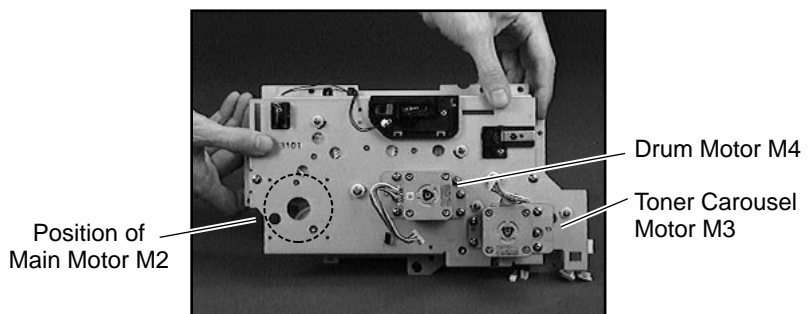
The main motor itself is not a part of the printer drive assembly but is available separately as P/N 922-1370.

**Toner  
Carousel Motor  
(M3)**

The toner carousel motor is a two-phase stepping motor controlled by the toner carousel motor driver (Q2003) on the mechanical controller board. This motor is part of the printer drive assembly and provides mechanical drive to the toner carousel.

**Drum Motor  
(M4)**

The drum motor is a two-phase stepping motor controlled by the drum motor driver (Q2002) on the mechanical controller board. The drum motor is part of the printer drive assembly. It provides mechanical drive to the photosensitive drum and to the transfer drum.

**Cleaning  
Brush Motor  
(M5)**

The cleaning brush motor is a DC motor. It is controlled by the CPU on the mechanical controller board and provides the mechanical drive that rotates the transfer drum cleaning brush.

**Scanner Motor**

The scanner motor is a three-phase, eight-pole DC brushless motor with a built-in hall element. The scanner motor rotates a six-sided mirror that in turn scans the laser beam, which has been emitted from the laser diode, in the horizontal scanning direction.



Basic Sequence of Operation

Outline

The following table describes the five periods of printer operation. .

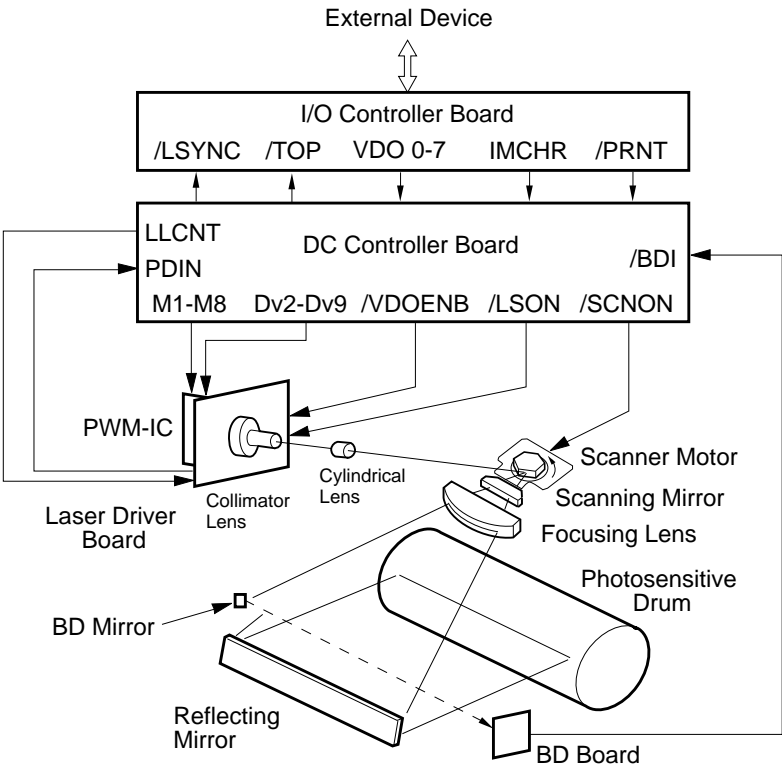
Period & Duration		Purpose	Remarks
WAIT	(Wait) From power-on until the fuser roller temperature reaches the target value. This period finishes in about three minutes at normal room temperature.	To warm up the fuser roller to put the printer in the standby state.	During this period, the printer checks for jammed paper and for availability of all the toner cartridges. It also performs image stabilization and other tasks.
STBY	(Standby) From the end of the WAIT period until the /PRINT signal is input from the I/O controller.  From the end of the LSTR period until the /PRNT signal is input from the I/O controller or the power switch is turned off.	To hold the fuser roller at the target value to keep the printer ready to print.	If the printer stays in the standby state for 30 minutes or more, it drives the main motor for 0.5 second to rotate the fuser roller, so that the fuser roller will not be deformed.
INTR	(Initial Rotations) After the /PRNT signal has been input from the I/O controller until the transfer drum rotates up to the top position for the first color.	To stabilize the sensitivity of the photosensitive drum in preparation for printing.	When the scanner motor reaches the target speed, the DC controller sends the print sequence command to the mechanical controller.
PRINT	(Print) From the end of the INTR period and the subsequent completion of transfer until the transfer drum rotates up to the registration position.	To form an image on the photosensitive drum according to the /VDO signal input from the I/O controller and to transfer the image to the paper.	
LSTR	(Last Rotations) From the end of the PRINT period until the main motor stops.	To deliver the last print and to discharge the transfer drum.	Cleaning of the transfer drum occurs after every 100 prints.

### **III. Laser/Scanner System**

Laser System

Outline

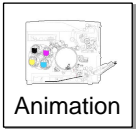
When the /PRNT signal is sent from the I/O controller, the DC controller performs Automatic Photoemission Control (APC) to stabilize the intensity of the laser beam. Upon completion of APC, the DC controller generates 8-bit video data signals (DV2-DV9) in accordance with the video signals (VDO0-VDO7) sent by the I/O controller and then sends them to the PWM-IC in the laser/scanner assembly. According to the laser drive signal (internal signal in the laser/scanner assembly) output from the PWM-IC, the laser driver circuit turns the laser diode on or off to produce the modulated laser beam.



The modulated laser beam is converted to a parallel beam with the collimator lens and cylindrical lens, and the beam then strikes the scanning mirror, which is rotating at a constant speed.

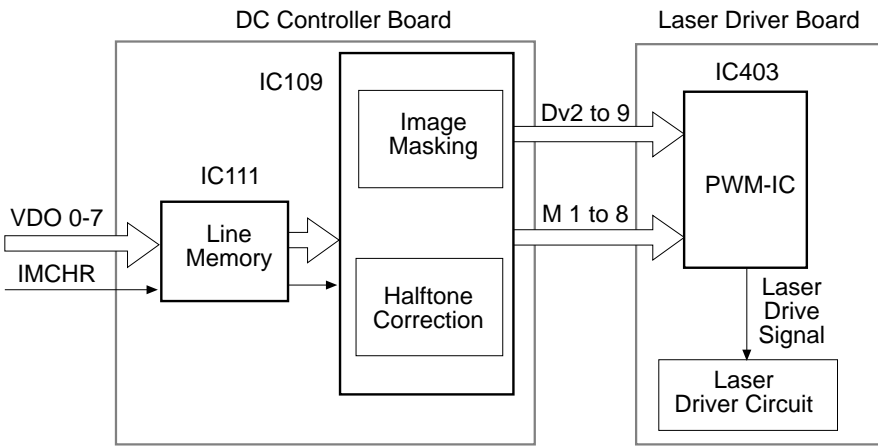
The laser beam reflected by the scanning mirror focuses on the photo-sensitive drum after passing through the focusing lens and being reflected by the reflecting mirror. Since the scanning mirror rotates at a constant speed, the laser beam scans at a constant speed across the photosensitive drum which also rotates at a constant speed. As a result, a latent image is formed on the photosensitive drum.

**Example:** The laser beam comes on in frame 62 for the magenta layer. The scanner mirror projects it right to left off the reflecting mirror, which projects it downward and to the right onto the surface of the photosensitive drum.



Video Data Processing

The video data supplied by the I/O controller is composed of 8-bit video signals (VDO0-VDO7) for each of four colors, M (Magenta), C (Cyan), Y (Yellow), and K (Black), and the Image Mode Select signal (IMCHR) which is used to set either the text mode (binary mode) or the image mode (halftone mode).



**Note:** In order to ensure that text and halftone images are each properly printed out, the printer switches its image mode via the IMCHR signal sent by the I/O controller.

In the image data of the printer there is both full-color mode and monochrome mode. In the full-color mode, the I/O controller sends the video signals in the order of M, C, Y, and K to the DC controller. In the monochrome mode, it sends the video signals for only a single color. The video signals (VDO0-VDO7) and the IMCHR signal sent to the DC controller by the I/O controller are sent to the gate array (IC109) via IC111 (line memory). IC109 processes VDO0-VDO7 to perform the image masking, halftone correction, etc.

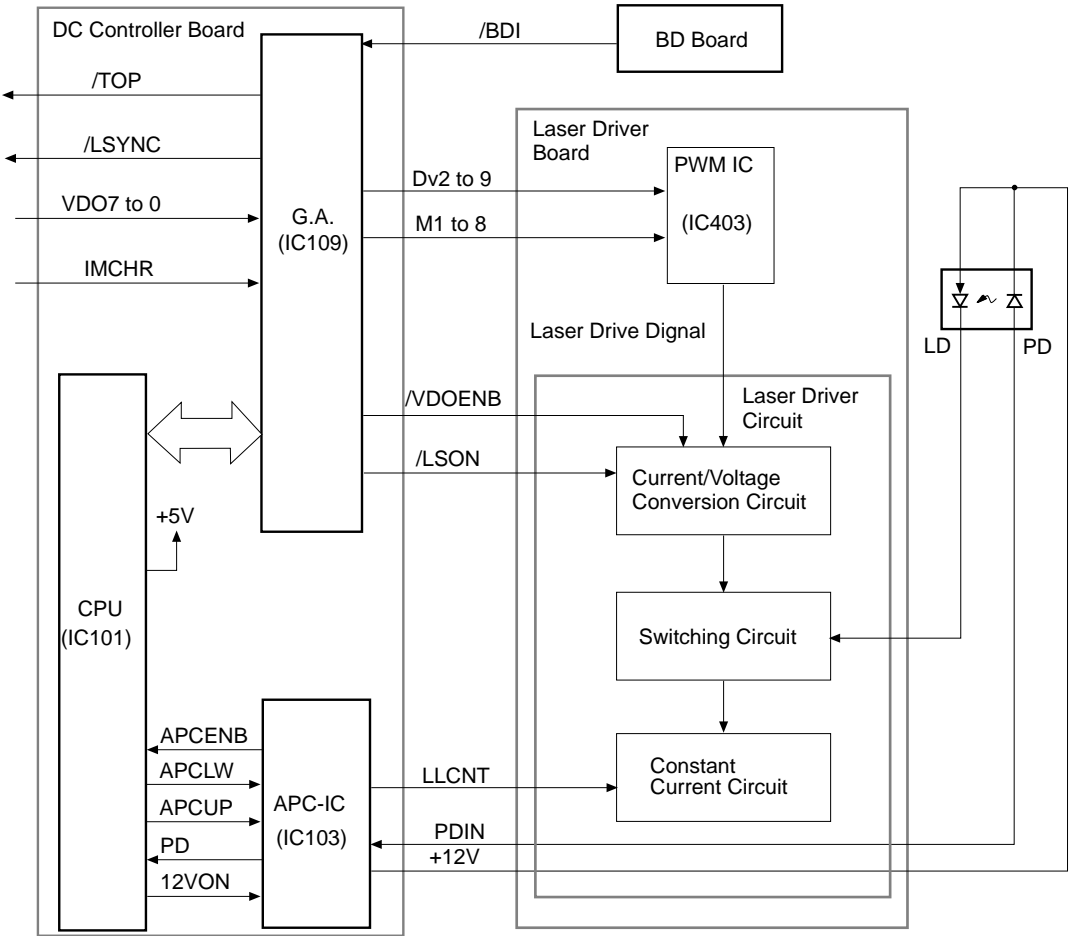
**Note:** The printer incorporates the halftone correction table in the DC controller so that the ideal halftone image can be obtained. This allows the video signals (VDO0-VDO7) sent by the I/O controller to be corrected and converted to the video data signals (DV2-DV9). They are subsequently output to the laser driver.

The signals are then converted to 8-bit video data signals (DV2-DV9) and mode setting signals (M1-M8) in IC109 and then sent to the PWM board in the laser/scanner assembly. The DV2-DV9 signals are video data signals containing halftone information. The M1-M8 signals control the image mode selection, etc. The PWM circuit modulates the DV2-DV9 signals into PWM signals and sends them as laser drive signals to the laser driver board.

The printer includes an anti-counterfeiting function whereby a pattern unique to the printer is invisibly marked on every printout.

Laser Control Circuit

**Laser Emission**     The DC controller generates 8-bit video data signals (DV2-DV9) and mode setting signals (M1-M8) in the gate array (IC109) in accordance with the video signals (VDO0-VDO7) and image mode select signal (IMCHR) sent by the I/O controller. It sends those signals to the PWM-IC in the laser driver board. Based on the above signals, the PWM-IC produces laser drive signals with the pulse width corresponding to the halftone, and then sends them to the laser driver circuit. At this time, when the forcible laser-on signal (/LSON) sent to the laser driver circuit is “H” and the video-enable signal (/VDOENB) is “L,” the laser driver board turns the laser diode on in accordance with the laser drive signal.



**Note:** The APC-IC monitors the voltage levels of the 5 V and 24 V power supplies. If both voltage levels exceed the specified value, the laser driver board uses 12 V power supply produced from the 24 V power supply.

## Laser Intensity Control

The CPU in the DC controller controls the intensity of the laser beam by using the APCUP signal for rough control and the APCLW signal for fine control. The APC-IC (IC103) adds the APCUP and APCLW signals to produce the laser beam intensity control signal (LLCNT), which is then output to the laser driver circuit in the laser/scanner assembly. The CPU performs automatic power control (APC) of the laser diode and adjusts the LLCNT signal so that the laser diode will emit the laser beam at the constant intensity. The APC is composed of initial APC and between-pages APC.

## Initial APC

The printer performs the initial APC in the following steps while it is executing the initial rotations.

- 1 When the APC enable signal (/APCENB) goes “L,” the CPU decreases the output values of the laser power control signals (APCLW and APCUP) to zero. After resetting the laser current, the CPU rotates the scanner motor.  
  
**Note:** The /APCENB signal goes “L” when the 5 V and 24 V power supplies are at the specified voltage.
- 2 The CPU sets the forcible laser-on signal (/LSON) to “L” and the video-enable signal (/VDOENB) to “L” via the gate array. It changes the D/A output value of the APCUP signal and gradually increases the laser diode current. When the laser current increases, the laser diode starts emitting the laser beam. The intensity of the laser beam emitted by the laser diode is detected by the photodiode (PD) and its output voltage is fed back as the laser power detect signal (PDIN) to the APC-IC.
- 3 The CPU monitors the PDIN signal. Until its value reaches the specified value stored in the CPU, step 2 is continued.
- 4 The between-pages APC described below is subsequently performed during the remaining period of the initial rotations to correct the offset from the target value.
- 5 The CPU sets the /LSON signal to “H” to complete the initial APC and then proceeds to the between-pages APC.

**Between-  
Pages APC**

Immediately after the initial APC, the printer performs the between-pages APC for pages and colors. The CPU sets the /VDOENB signal to “H” during the unblanking period.

**Note:** In order to detect the /BDI signal, the laser diode is turned on even during the period that it does not scan the laser beam across the drum. This is referred to as the “unblanking period.”

This causes the laser diode to emit the laser beam at the intensity set during the initial APC. To ensure that the PDIN signal is at the specified value, the APCLW signal (8-bit) is changed to correct the LLCNT signal so as to compensate for the offset from the target value.

**Horizontal  
Sync Control**

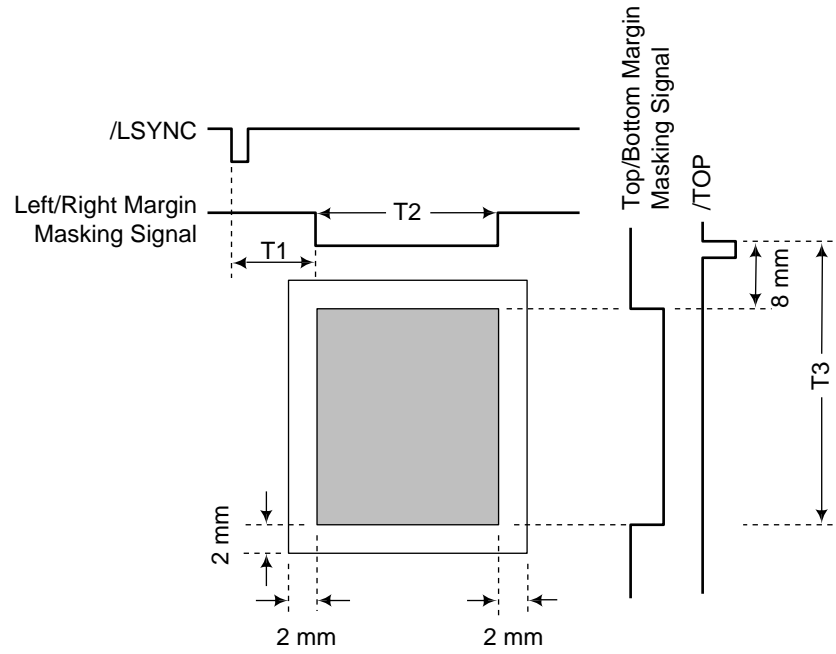
A small beam-detect (BD) mirror is fixed in the optical path of the laser beam. Upon reaching the scanning start position, the laser beam is reflected by the BD mirror to the BD board in the laser/scanner assembly during the unblanking period. On receiving the laser beam, the BD board generates the beam detect input signal (/BDI) and then sends it to the gate array in the DC controller board. The gate array produces the horizontal sync signal (LSYNC) based on the /BDI signal and then sends it to the I/O controller.

Laser Diode  
Emission  
Control

The laser driver circuit turns the laser diode on or off in accordance with the laser drive signal received from the PWM-IC when the video-enable signal (/VDOENB) is “L” and the forcible laser-on signal (/LSON) supplied by the DC controller is “H.” The gate array (IC109) applies left/right and top/bottom margin masking to the video signals (VDO7-VDO0) in accordance with the paper size data sent by the I/O controller, and then sends them as DV2-DV9 signals to the PWM-IC in the laser/scanner assembly. The paper size data is supplied to the CPU by the cassette-size sensing switch for cassette paper feed or by the paper size specification command issued by the I/O controller for manual paper feed.

Notes:

- 1 The shaded area permits writing with the laser beam.
- 2 Times T1 and T2 vary depending on the paper size.
- 3 If no paper size is specified by the paper size specification command from the I/O controller for manual feed, the printer does not recognize the paper width. So the T1 and T2 values are assumed to be legal size, the maximum paper width for the printer. The CPU determines the actual paper size from the paper length detected by the paper leading-edge sensor (PS303) when the leading edge of the paper has passed through PS303. Subsequently, the image is masked based on the detected paper size.

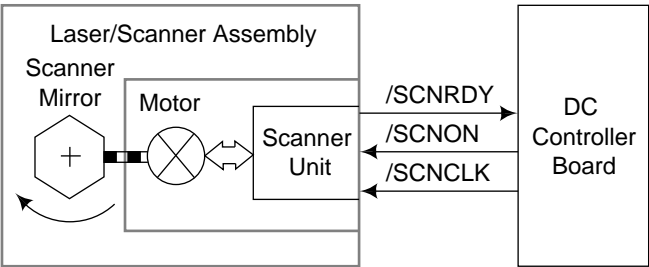




## Scanner System

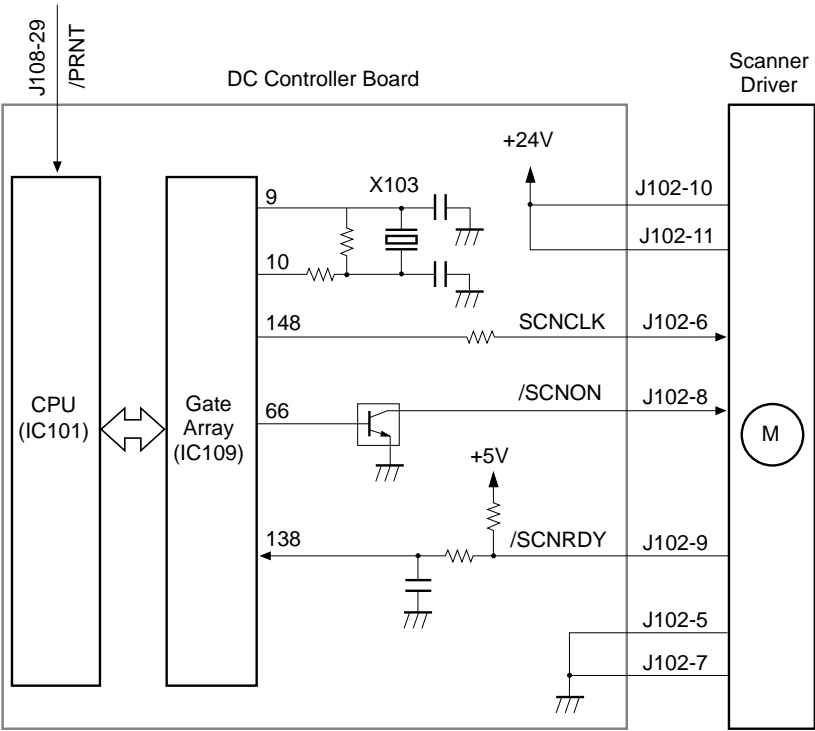
**Outline**

The scanning mirror is a critical part in the scanner unit. It is mounted on the scanner motor shaft and rotates with the scanner motor. The rotation of the scanner motor is controlled by the scanner driver, so that the laser beam reflected by the scanning mirror scans across the photo-sensitive drum at a constant speed. When the scanner motor drive signal (/SCNON) and the scanner clock signal (SCNCLK) are sent to the scanner driver by the DC controller, the scanner driver rotates the scanner motor.



Scanner Motor  
Circuit

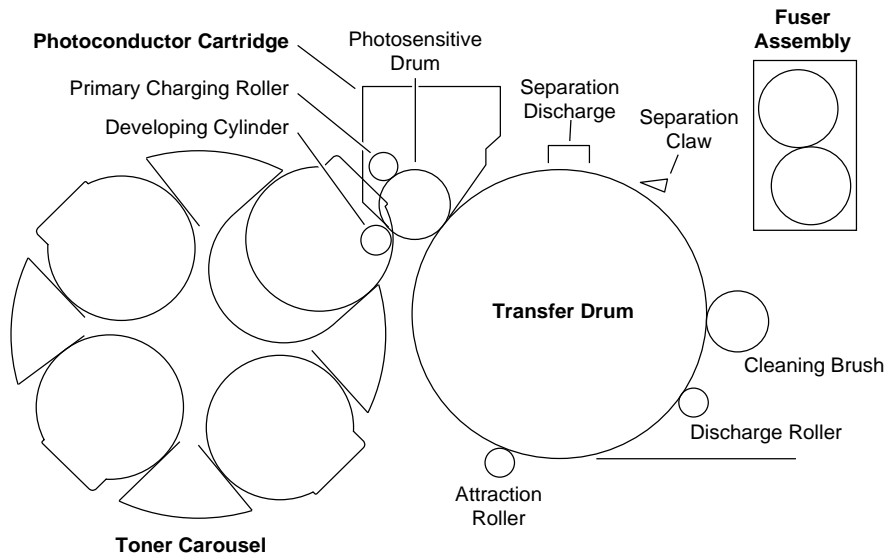
The scanner motor is a three-phase, 8-pole DC brushless motor with a hall element. It is incorporated in a single unit with the scanner driver which controls it so that the motor rotates at a constant speed. When the printer is turned on, the oscillation frequency of the crystal oscillator (X103) is divided by the gate array (IC109) and the resulting signal is sent as the SCNCLK signal to the scanner driver. When the /PRNT signal that is sent to the CPU (IC101) on the DC controller goes “L,” the CPU sets the /SCNON signal to “L” via the gate array and rotates the scanner motor. When the scanner motor reaches the specified speed, the scanner motor ready signal (/SCNRDY) goes “L.” The CPU on the DC controller issues the print sequence command to the CPU on the mechanical controller when the /SCNRDY signal goes “L.” The CPU on the DC controller monitors the /SCNRDY signal via the gate array to determine whether or not the scanner motor is rotating at the specified speed. If the scanner motor fails to reach the specified speed within 30 seconds after it starts rotation, the CPU will stop it and notify the I/O controller of this scanner failure.



## **IV. Image Formation System**

Outline

The image formation system is the nucleus of the printer. Its major components are the photoconductor cartridge, transfer drum, toner carousel with toner cartridges, and fuser assembly.

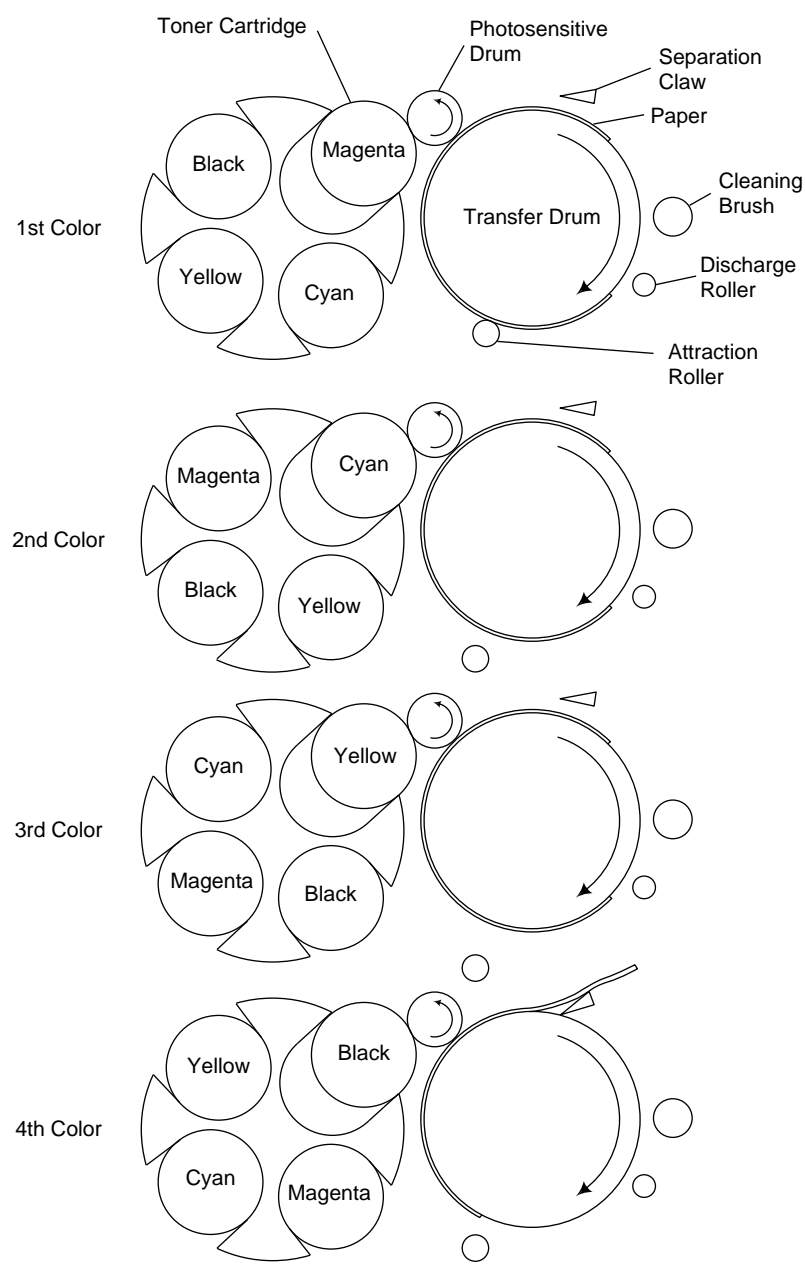


Upon receiving the /PRNT signal from the I/O controller, the DC controller completes the designated processing and sends the print sequence command to the mechanical controller. The mechanical controller drives various motors and the press cams, which transfer drive throughout the image formation system.

The primary charging roller negatively charges the surface of the photosensitive drum just before the drum surface is irradiated by the laser beam. The latent image formed across the photosensitive drum is made visible by toner from the toner cartridge, and the image is transferred to the paper on the transfer drum. The surface of the photosensitive drum is cleaned to remove residual toner, and the latent imaging cycle continues.

These steps are taken for each color. The paper is fed onto the transfer drum and remains there until the transfer process has been completed. The paper is then separated from the transfer drum and is delivered to the fuser assembly.

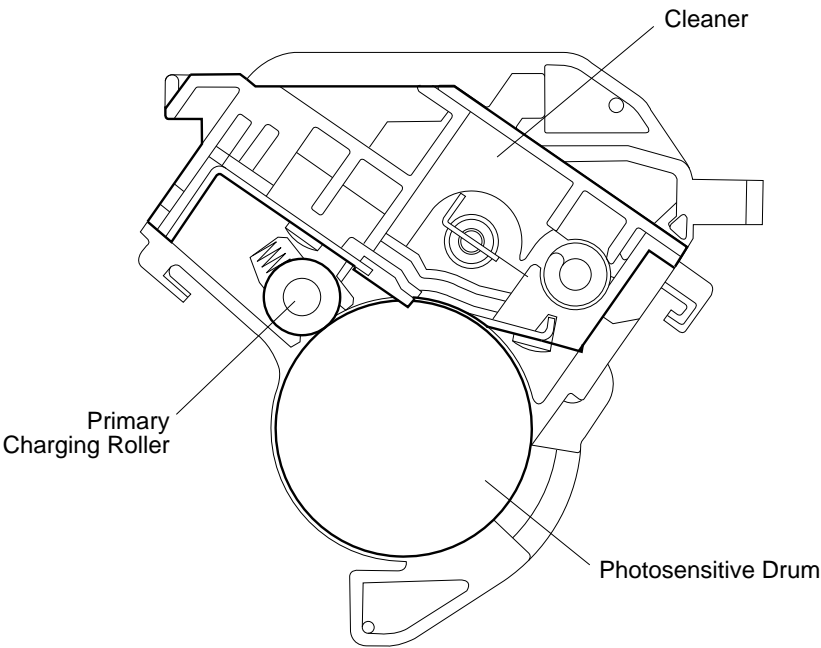
The transfer drum is also cleaned periodically to remove toner. However, its surface is discharged to eliminate remaining charges. See “Imaging Stage 4: Transfer Drum Cleaning and Discharge” later in this chapter.



## Photoconductor Cartridge

Outline

The photoconductor cartridge comprises the primary charging roller, photosensitive drum, and cleaner unit.



The external surface of the photosensitive drum is a photoconductive layer using an organic photoconductor (OPC), and the inner side is an aluminum substrate. The primary charging roller is formed with rubber of medium resistance, and operates in coordination with the photosensitive drum.

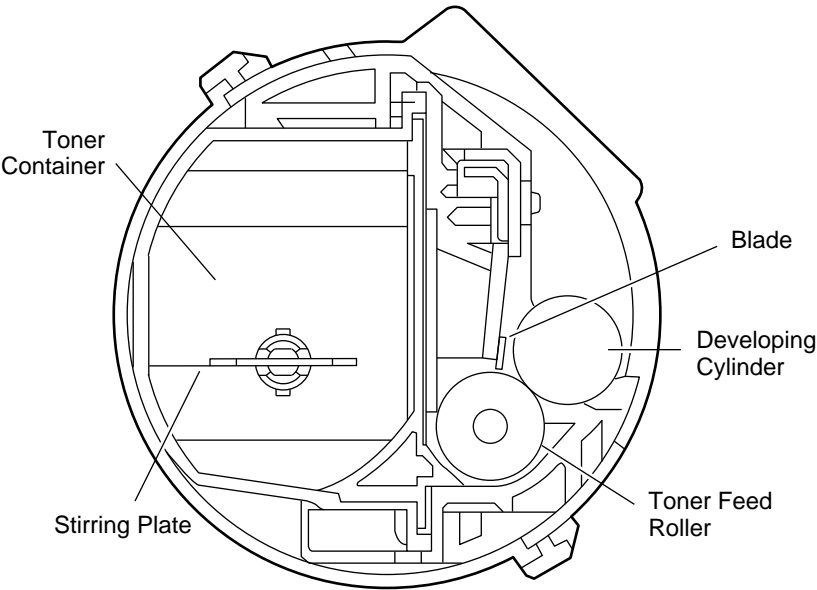
## Toner Cartridge

### Outline

The toner cartridge includes a toner container with stirring plate, a toner feed roller, rubber blade, and developing cylinder. The developing cylinder, toner feed roller, and stirring plate receive rotational drive through the white toner cartridge drive gear on the photoconductor drive shaft. Toner carousel motor M3 supplies this drive in sync with the drive supplied to the photosensitive drum by drum motor M4.

This internal drive train of the toner cartridge engages with the toner cartridge drive gear only during the “press” position

**Note:** See “Toner Carousel Control” later in this chapter for full description of “home,” “stop,” “press,” and “fetch” positions.



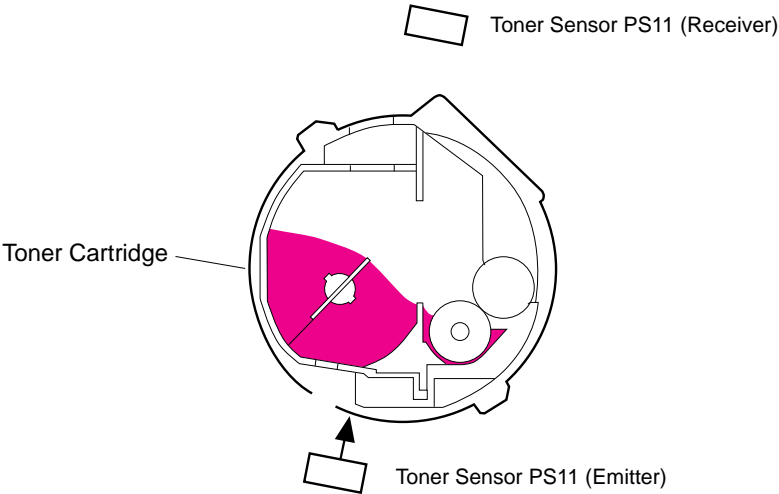
### Toner Stirring Function

The toner cartridge stirring mechanism consists of the stirring plate and toner feed roller and helps in supplying toner from the toner container to the developing cylinder. The stirring plate agitates the toner within the container. The feed roller is responsible for applying a thin layer of toner onto the developing cylinder.

Cartridge-  
Presence  
Detection

The printer has cartridge-presence and toner-level detecting functions. Both these functions are served by toner sensor PS11. Cartridge presence is sensed when the cartridge is in the “stop” position.

When a toner cartridge is in the “stop” position, the LED of toner sensor PS11 emits lights through a light pipe in the toner carousel. Each cartridge bay has its own light pipe. The light emitted from the light pipe is normally blocked by the cartridge and does not reach the receiving diode of PS11 mounted above the toner carousel.



If the light does reach the receiving diode, the DC controller determines that no cartridge is installed in that bay and notifies the I/O controller.



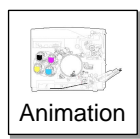
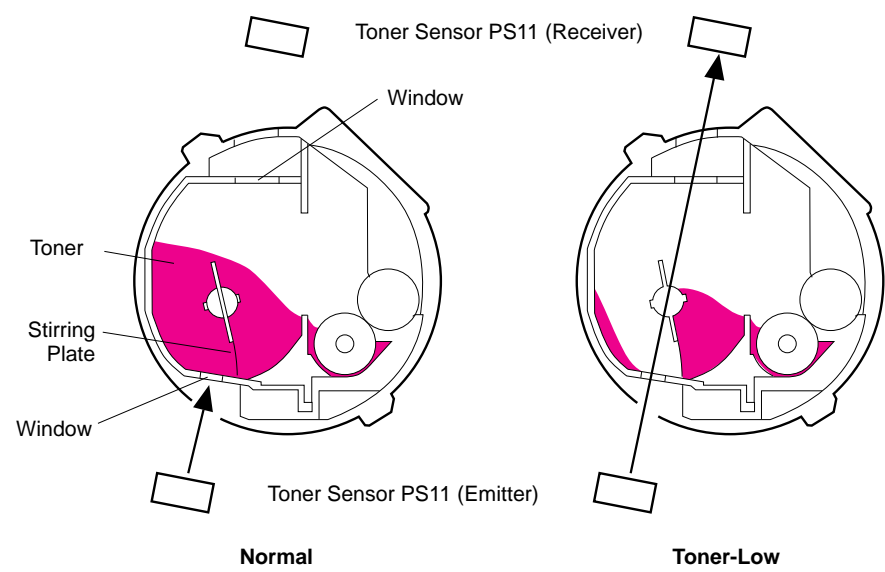
**Sound:** Cartridge-presence sensing occurs after printer startup or following the actuation of the toner ejection sensor. The controller rotates the carousel to each of the four stop positions, confirms that a cartridge occupies each bay, then continues its startup sequences. Click the icon to the left for a sound sampling of the carousel during cartridge-presence sensing.



Toner-Level  
Detection

When it presses against the photosensitive drum, the cartridge shifts just enough so that the light from PS11 aligns with a window in the bottom of the cartridge. In a totally empty cartridge, the light beam would shoot through this window, out a second window in the top of the cartridge, and strike the receiving diode of PS11.

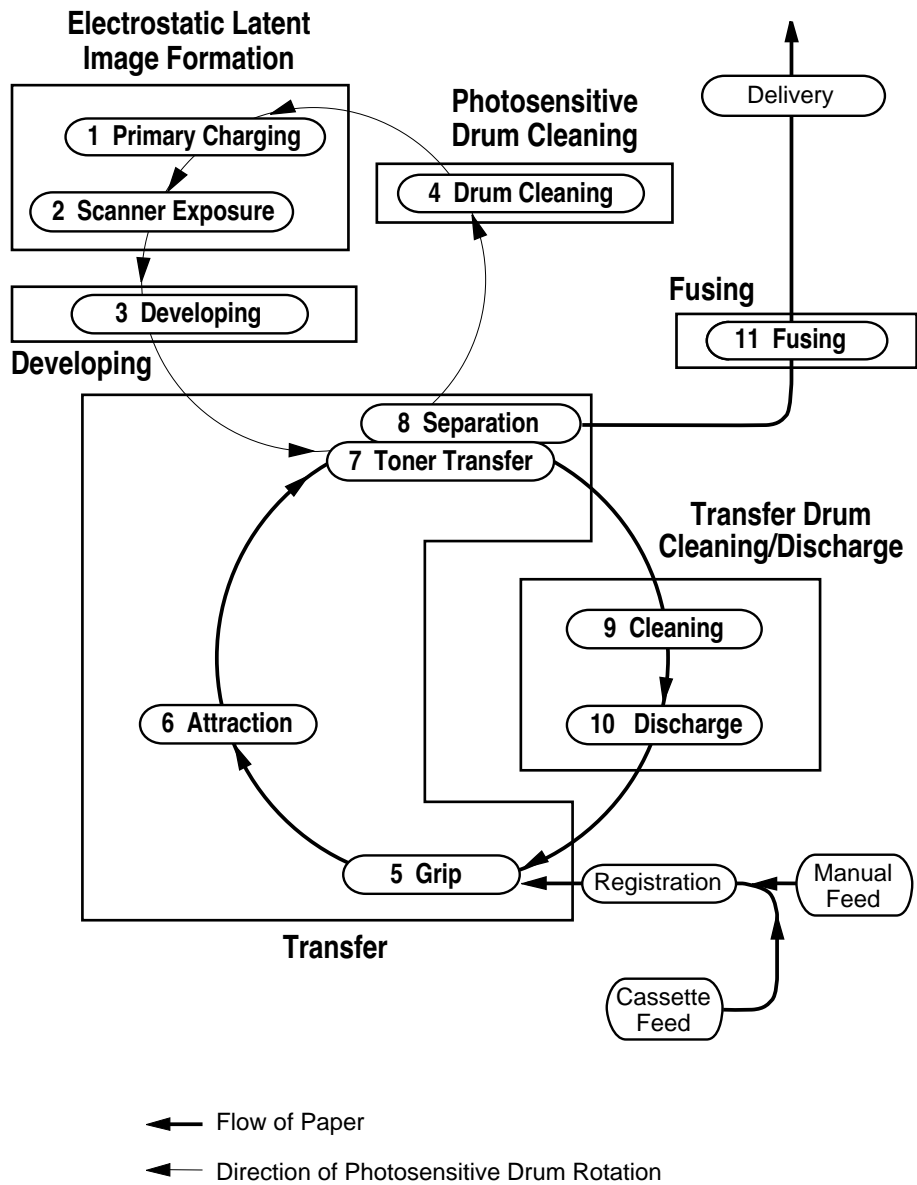
In a normal cartridge, the controller judges level of toner by measuring the duration that light strikes the receiving diode after the stirring plate has swept in front of the bottom window. If the duration is longer than a prescribed value, the DC controller determines that the toner is low and notifies the I/O controller.



**Example:** See the cyan cartridge in frame 116 of the animation. This is the position that a cartridge is in when toner level is detected. This position is called the “press” position. It is the only position in which the inner workings of the toner cartridge are mechanically driven. The cartridge is in the “stop” position in frame 115.

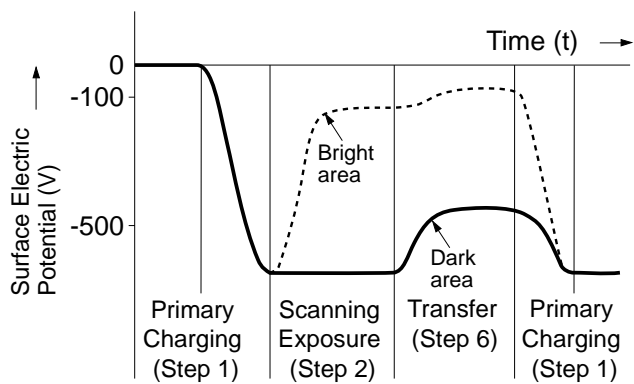
Stages of Imaging

The print process is roughly divided into the six stages shown below.



## Stage 1: Electrostatic Latent Image Formation

This stage consists of two steps, primary charging and scanning exposure. Upon completion of this stage, the points on the drum that are struck by a laser beam have their charge neutralized, while those points not struck remain negatively charged. The image that is irradiated onto the drum in this manner is invisible and is therefore referred to as a “latent” image.

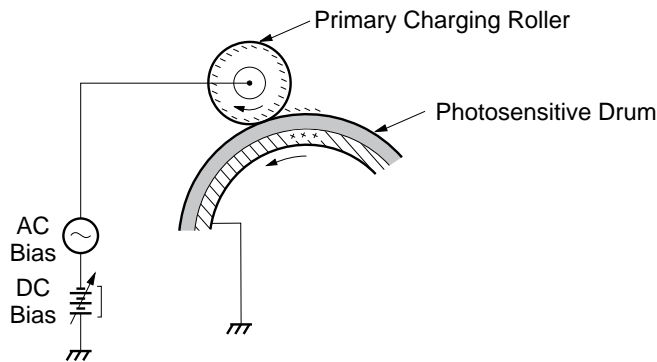


**Step 1:**  
**Primary**  
**Charging**

As a preliminary step in forming the latent image, the surface of the photosensitive drum is uniformly charged with negative potential. The primary charging is done by directly imparting charges onto the photosensitive drum.

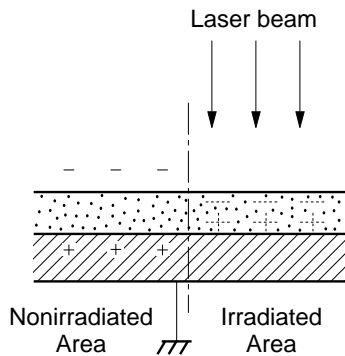
In order to keep uniform the surface potential charged on the surface of the photosensitive drum, AC bias is superimposed on the primary charging roller in addition to the DC bias.

The AC bias (current value) varies according to the values sensed for temperature and humidity to prevent toner from adhering to the charging roller.



**Step 2:**  
**Scanning**  
**Exposure**

When the laser beam is scanned across the photosensitive drum surface, the charge in the irradiated area is neutralized and becomes an electrostatic latent image. This is known as “write-black” laser imaging.



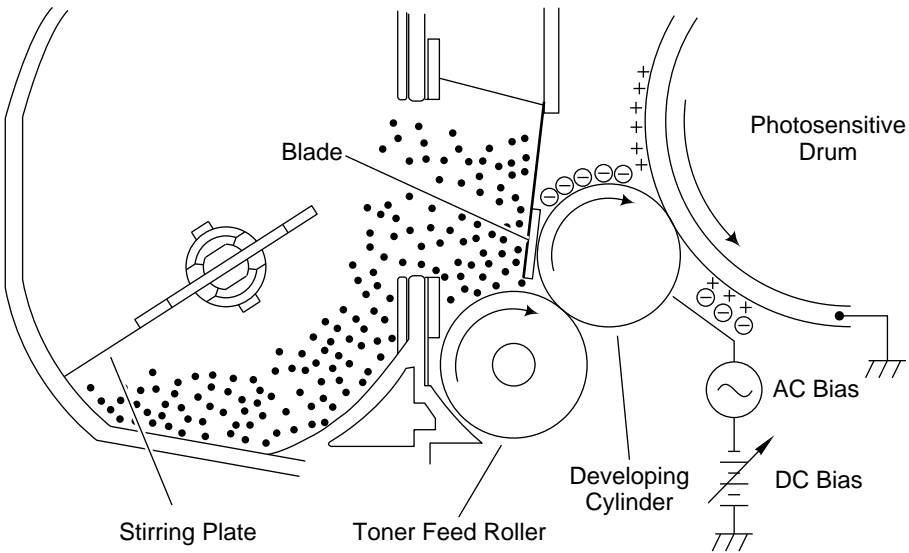
## Stage 2: Developing

In this stage, the toner is placed on the electrostatic latent image on the photosensitive drum, making the image visible.

### Step 3: Developing

The toner used for the printer is a single-component nonmagnetic toner composed of resin. This toner is unique for its insulating property, and is charged with negative potential by friction between the rotating cylinder and blade surface.

The toner comes in four colors: magenta, cyan, yellow and black. Each is contained in its own toner cartridge. Each toner cartridge is housed within the toner carousel and is sequentially advanced to the photosensitive drum in line with the rotation of the carousel. See “Carousel Rotation” later in this chapter.



**Note:** The irradiated areas on the photosensitive drum have a neutral charge. For sake of clarity, these irradiated areas are shown as plus signs (+) since their potential is higher than the charge of toner particles on the developing cylinder.

The laser-beam-irradiated area on the photosensitive drum is higher in potential than the toner negatively charged on the cylinder. When this area comes close to the negatively charged toner on the cylinder, the toner jumps and adheres to the drum surface due to the difference in potential between the drum surface and the cylinder.

This effect is called toner projection development and makes the electrostatic latent image on the photosensitive drum surface visible.

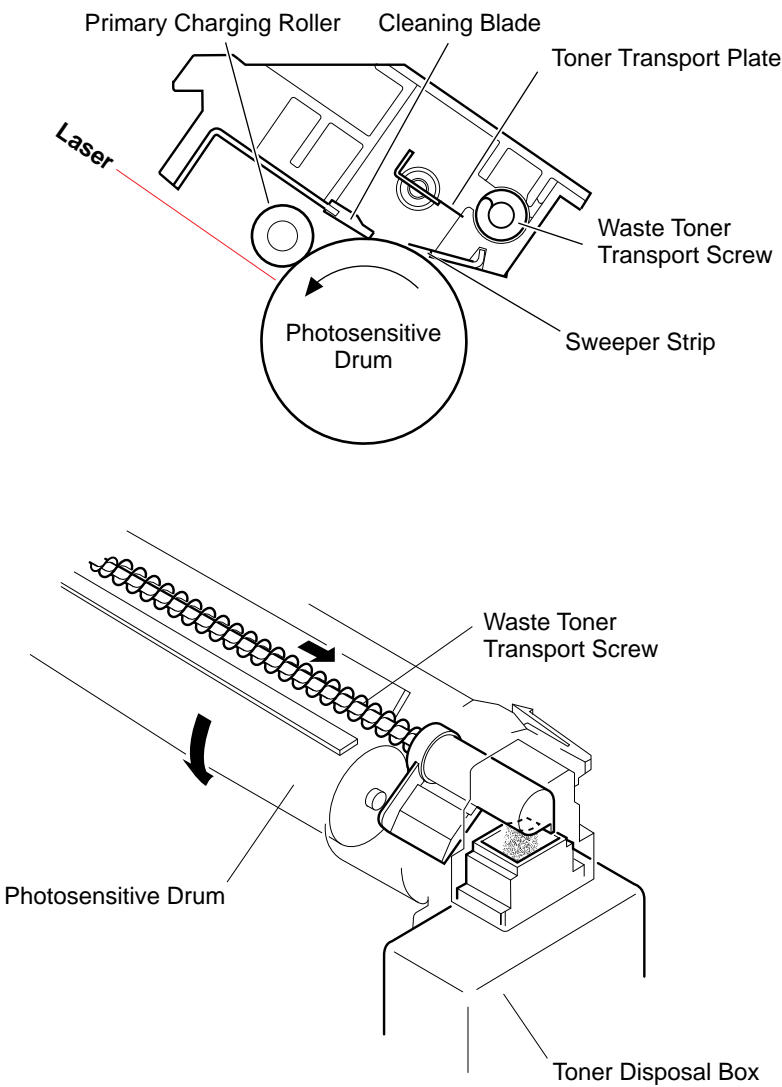
AC bias is applied to the developing cylinder for ease of projecting toner to the photosensitive drum surface and in order to improve the contrast of the output image. DC bias varies in response to density calibration and the operation of the density control panel.

Stage 3: Photosensitive Drum Cleaning

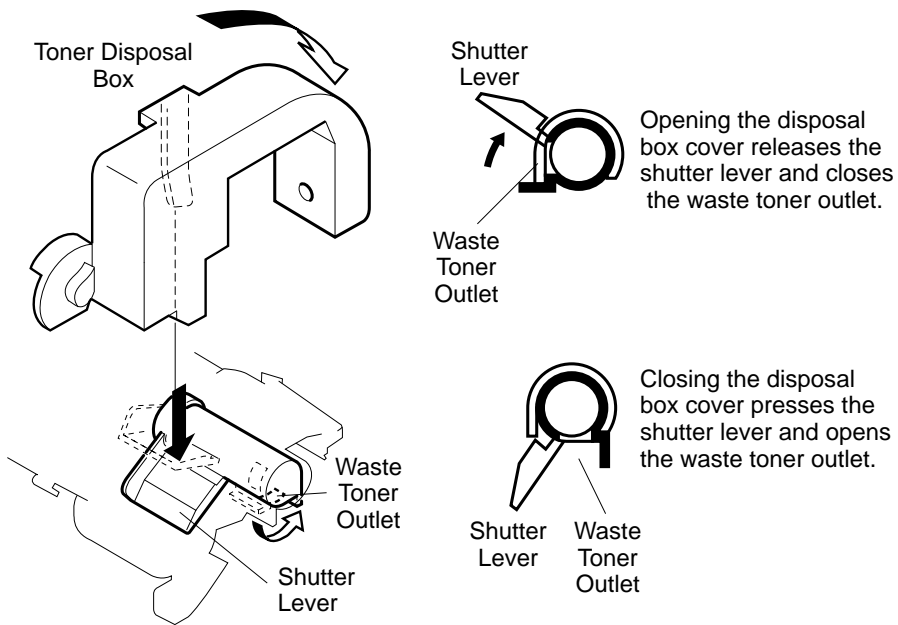
Step 4:  
Photosensitive  
Drum Cleaning

During the transfer stage, a small amount of toner does not transfer onto the paper. To prepare for the next imaging cycle, the toner remaining on the photosensitive drum surface is scraped by the cleaner blade and the drum is cleaned.

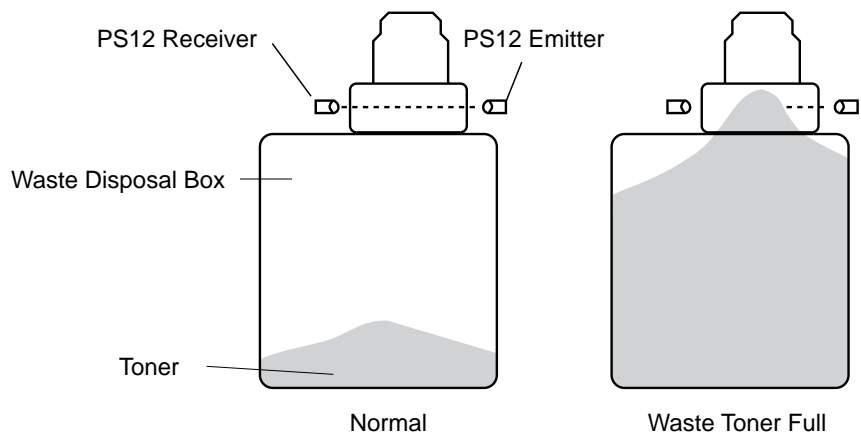
The scraped toner particles are trapped with the sweeper strip and collected in the toner disposal box by means of the toner transport plate and the waste toner transport screw. The waste toner transport screw is driven by the main motor.



When the photosensitive drum door opens, the shutter lever is released, and the waste toner shutter of the photoconductor closes so that the waste toner is no longer exhausted.



The waste toner level is detected by the waste toner sensor (PS12) housed in the disposal box cover assembly. When the waste disposal box gets full, the DC controller notifies the I/O controller of the waste toner full condition and stops the printer.

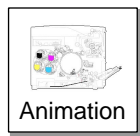
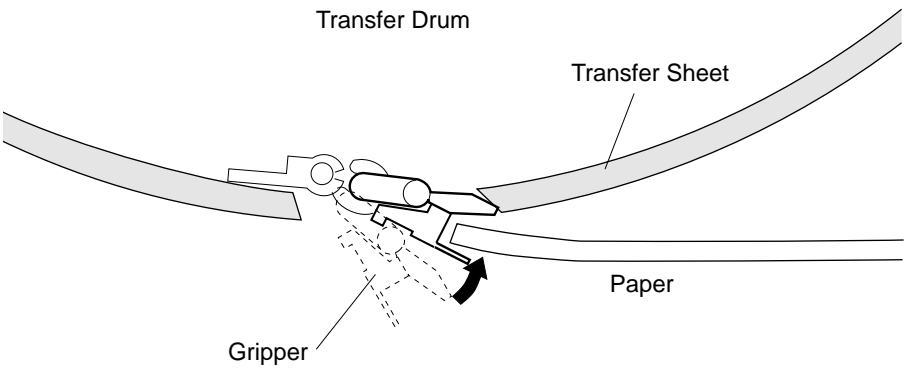


Stage 4: Transfer

This stage consists of four steps: grip, attraction, transfer, and separation. This stage is where the toner image is mapped from the photosensitive drum onto the paper.

Step 5:  
Grip

When the paper reaches the transfer drum, its leading edge is retained by the gripper so that the paper is retained on the transfer drum surface. Since the leading edge of the paper is retained by the gripper, approximately 8 mm of the leading edge cannot be imaged.



**Example:** The leading edge of the paper is gripped in frame 55 of the animation.

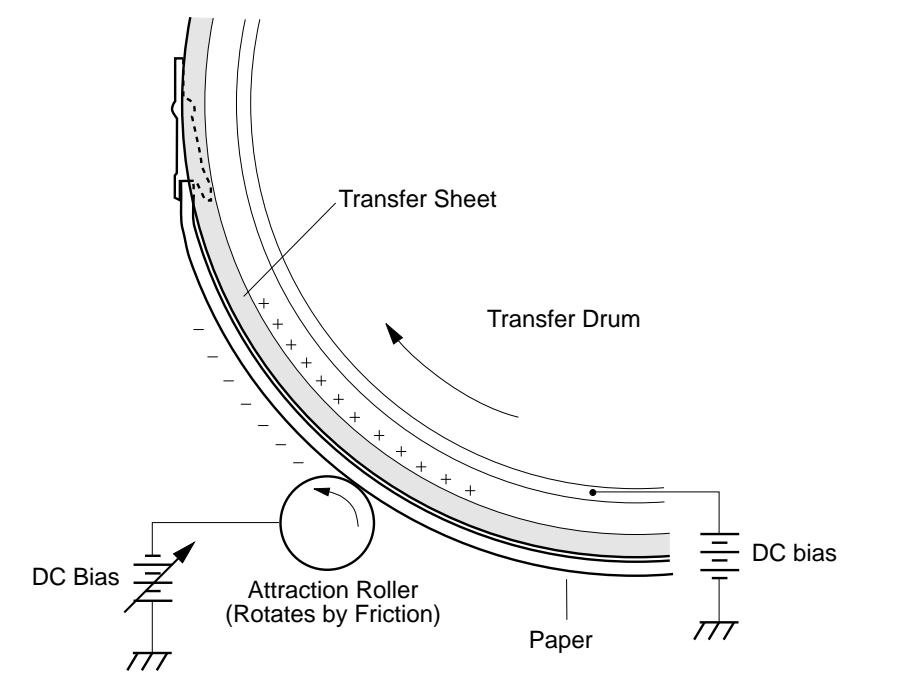


Step 6:  
Attraction

The attraction roller imparts negative charges onto the paper and helps hold the paper to the transfer drum surface by means of electrostatic force. The attraction roller presses only for the first color and separates from the transfer drum upon completion of the transfer operation for the first color.

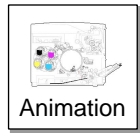
**Note:** If you select “Best” as the print quality mode, the entire sheet receives the attraction charge prior to any imaging. This assures the best possible attraction of paper to drum and requires one extra rotation of the transfer drum.

For monochrome and continuous print operation, the attraction roller is separated from the transfer drum upon completion of a single-page transfer, and returns to the drum before the transfer starts for the next page.



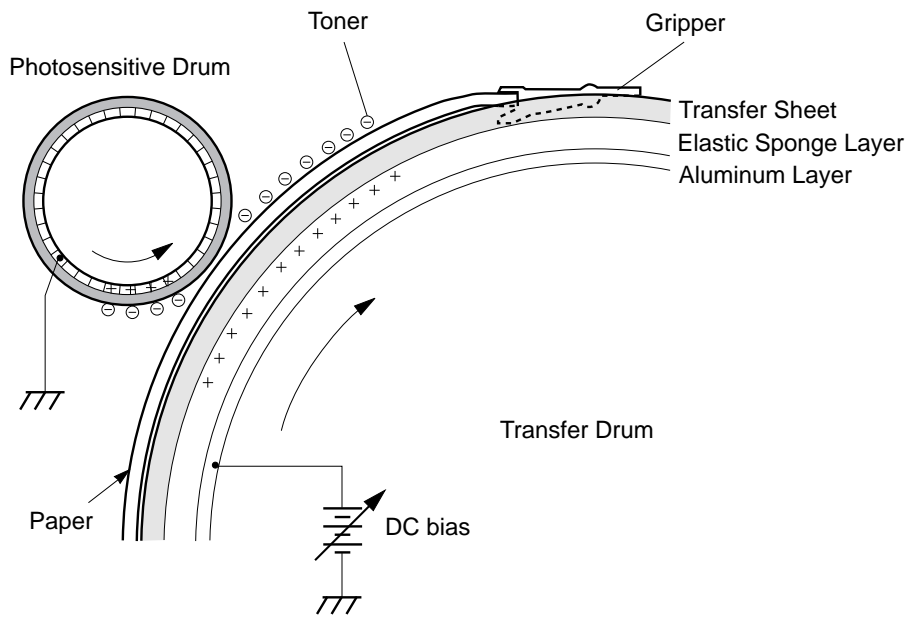
DC bias is applied to the attraction roller. The value of the DC bias varies in line with the temperature/humidity sensing system.

**Example:** The attraction roller presses in frame 59 of the animation and separates in frame 89 after the trailing edge of the paper passes.



Step 7:  
Toner  
Transfer

The paper attracted to the transfer drum is transported in correspondence with the rotation of the transfer drum. At this time, positive charges are applied to the reverse side of the transfer sheet to transfer the toner from the photosensitive drum to the paper. This process repeats sequentially for each color (M, C, Y, K).



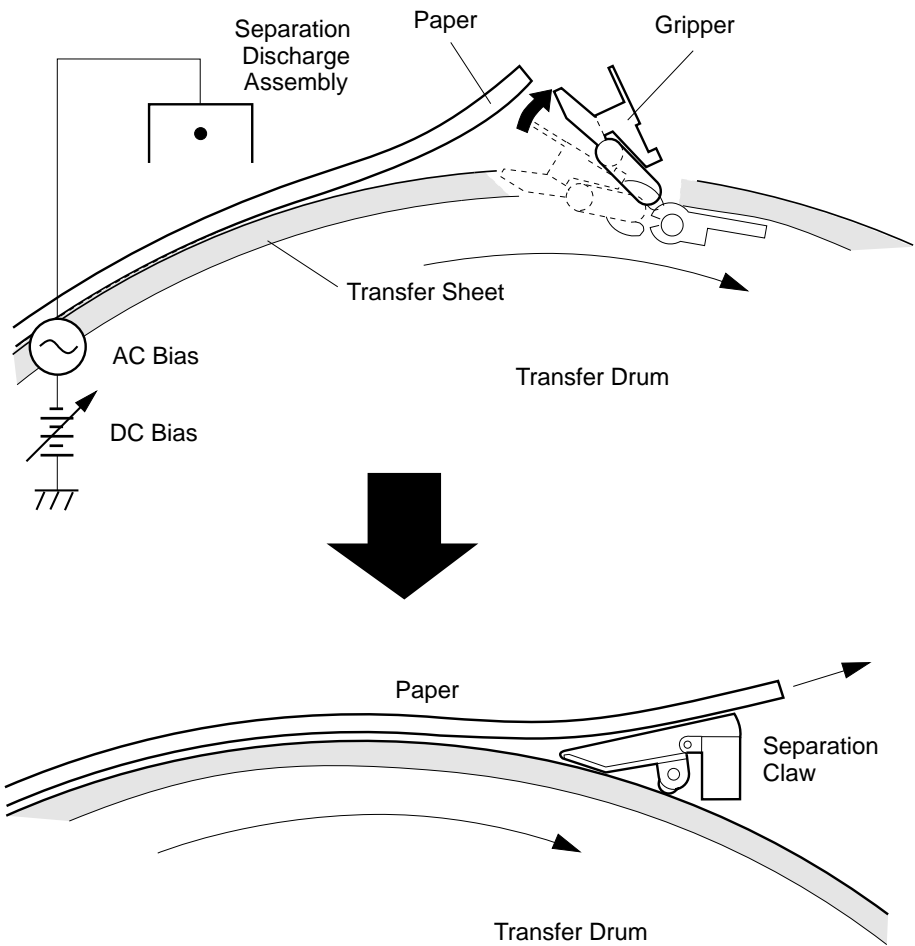
The transfer drum consists of an internal aluminum cylinder covered successively by a conductive elastic sponge layer and an external insulating transfer sheet.

DC bias is applied to the transfer drum. The value of the DC bias varies in line with the temperature/humidity sensing system.

In full-color mode, as the transfer steps proceed with the first color, second color, and so on, the transfer force weakens due to the increase in the number of negatively-charged toner particles on the paper. To counteract this effect, the transfer bias is gradually increased for the second and subsequent colors.

Step 8:  
Separation

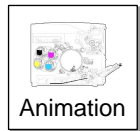
Paper is separated from the transfer drum by the gripper and separation claw. After passing through the separation discharge assembly, the leading edge of the paper is pushed up by the gripper and the paper is separated from the transfer drum surface by the separation claw.



In a low temperature and low humidity environment, the separation discharge assembly is activated to assist in separating the paper from the transfer drum.

**Note:** The separation discharge assembly can be forced on or off manually by means of the density control panel. See “Separation Voltage Designation” earlier in this chapter.

**Example:** The separation claw actuates in frame 232 of the animation. The paper then separates from the drum and feeds toward the fuser assembly. The leading edge of the paper trips separation sensor PS7 in frame 237.



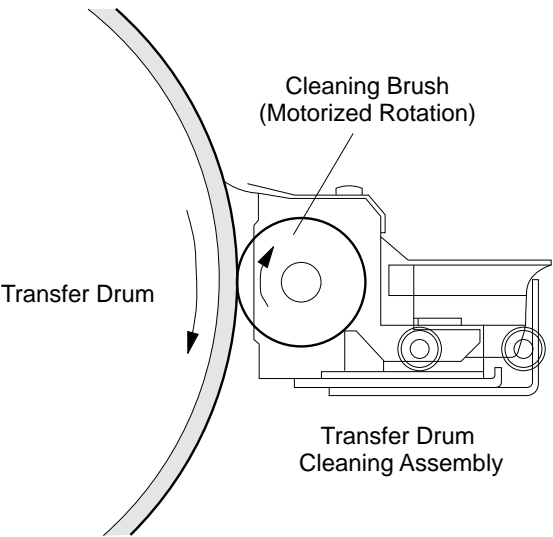
## Stage 5: Transfer Drum Cleaning and Discharge

After the page has left the transfer drum, the printer must return the drum to a clean and electrically neutral state.

### Step 9: Transfer Drum Cleaning

During density calibration and after some paper jams, unfused toner may find its way onto the surface of the transfer drum. The transfer drum cleaning brush is designed to scrape this residual toner off the transfer drum. This function takes place following density calibration and following the opening/closing of any of the doors. It also occurs as a routine maintenance measure after every 100 prints.

Collected toner is deposited in the filter of the transfer drum cleaner.

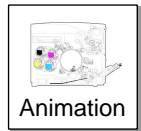


The cleaning brush is normally separated from the transfer drum. When the transfer process terminates and the paper leaves the transfer drum, the cleaning brush makes contact with the drum, cleans the surface, then separates from the drum.

**Note:** For more information, see “Transfer Drum Cleaning Assembly” in the “Pickup/Feed System” section of this chapter.

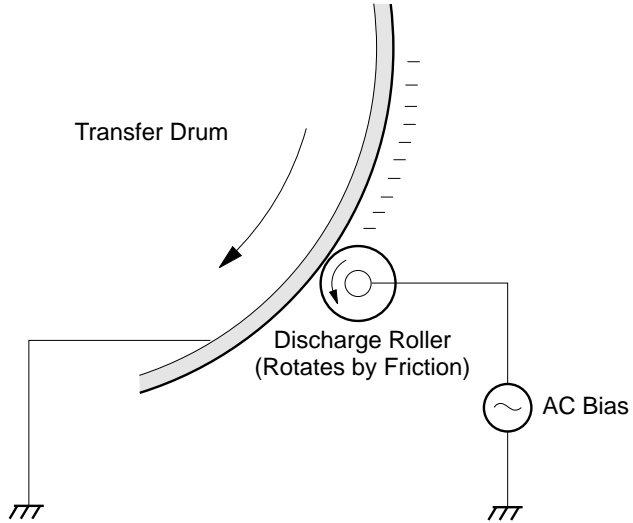
**Example:** The transfer drum cleaning assembly presses against the transfer drum in frame 223 of the animation, just after the trailing edge of the paper has passed. The assembly separates from the drum in frame 274. As noted above, this press and separation of the cleaning drum assembly occurs in this way only once in 100 prints.

**Sound:** The transfer drum cleaning assembly has a very distinctive whining type sound. Click the icon to the left to hear a sampling of this sound.



**Step 10:  
Discharge**

AC bias is applied by the discharge roller to eliminate charges remaining on the transfer drum surface after the separation of the paper. The value of the AC bias varies in line with the temperature/humidity sensing system.



**Note:** For more information, see “Discharge Roller” in the “Pickup/Feed System” section of this chapter.

**Example:** The discharge roller presses against the transfer drum in frame 228 of the animation, just after the trailing edge of the paper has passed. The assembly separates from the drum in frame 280.

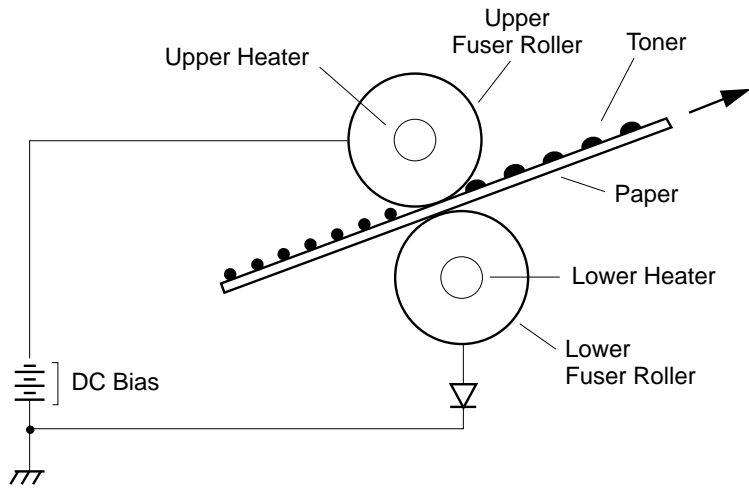


Stage 6: Fusing

Step 11:  
Fusing

In the transfer stage, the toner image transferred onto the paper adheres to it only by means of static electricity, and is susceptible to distortion when touched by hand. To avoid this problem, the fuser assembly fuses and mixes the paper and the four toners to create a permanent image.

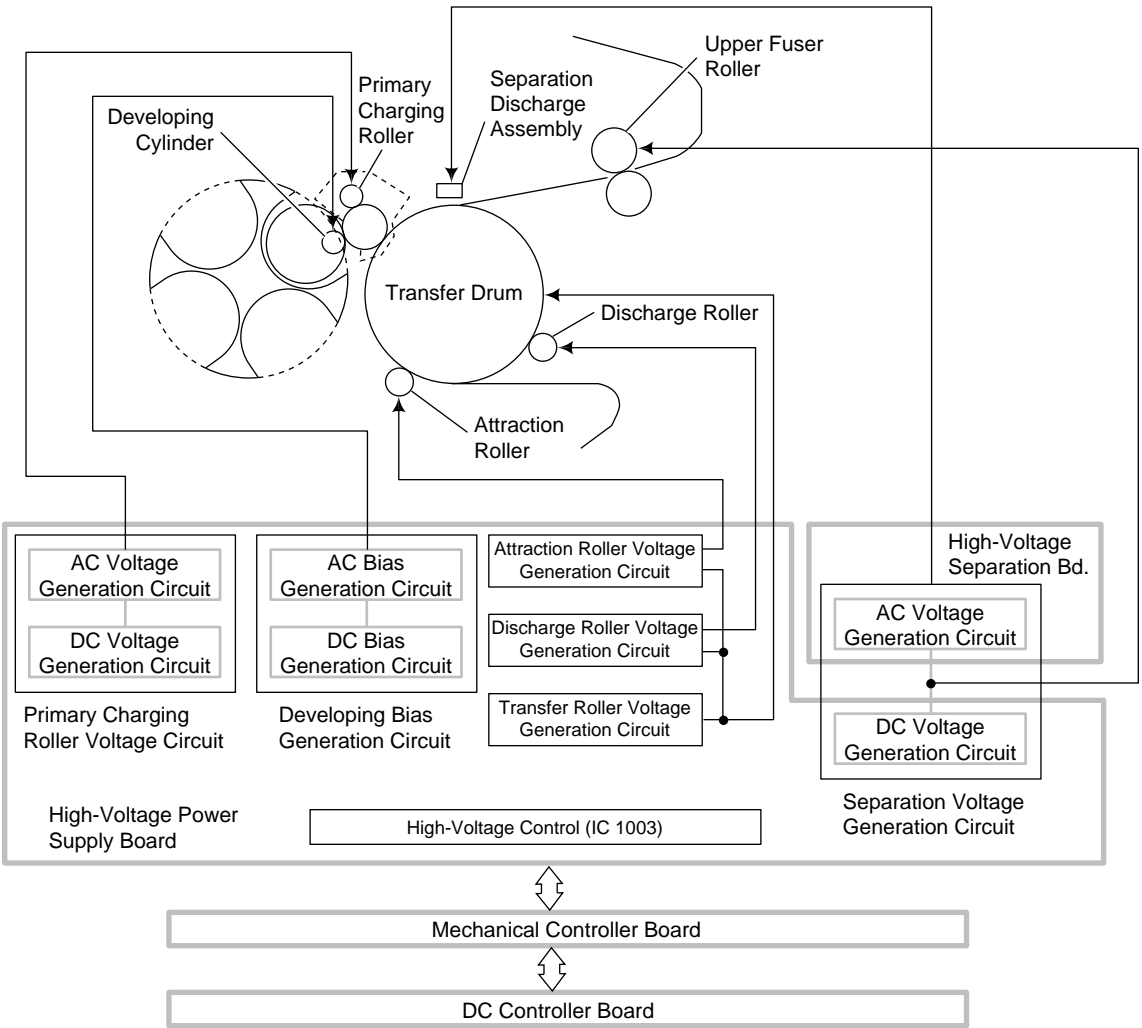
**Note:** For more information, see “Transfer Drum Cleaning Assembly” in the “Pickup/Feed System” section of this chapter.



High-Voltage Control: Outline

The high-voltage power supply of the printer is controlled by the high-voltage control IC (IC1003). In serial communication with the mechanical controller, IC1003 applies voltages to the primary charging roller, developing cylinder, transfer drum, attraction roller, discharge roller, separation discharge assembly, and upper fuser roller in response to the instructions from the mechanical controller.

The primary charging roller, the developing cylinder, and the separation discharge assembly are charged with superimposed DC and AC voltages. The transfer drum is charged with the positive DC voltage. The attraction roller is charged with negative DC voltage being superimposed onto the transfer voltage. The discharge roller is charged with AC voltage being superimposed onto the transfer voltage. The separation discharge assembly normally is charged only with DC voltage and is charged with AC voltage superimposed on DC voltage only in a low temperature and low humidity environment. The upper fuser roller is charged with DC voltage.



## High-Voltage Control: Operation

When the /PRNT signal sent from the I/O controller goes “L,” and the print sequence command is entered from the DC controller to the mechanical controller, the mechanical controller rotates the drum motor and controls the high-voltage control IC (IC1003) on the high-voltage power supply board as follows.

### Voltage to Primary Charging Roller

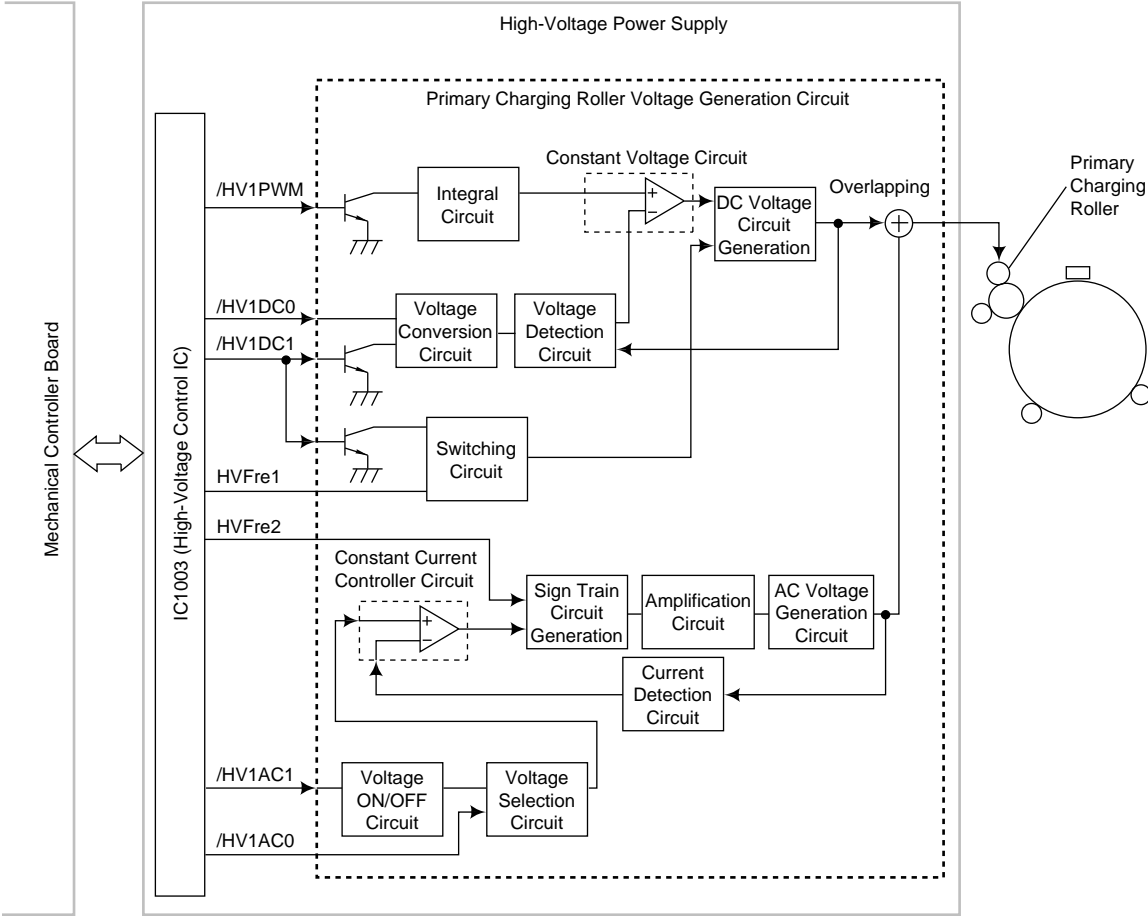
The high-voltage control IC (IC 1003) on the high-voltage power supply board outputs the primary charging DC voltage drive signal (/HV1DC1), primary charging AC voltage drive signal (/HV1AC1), primary charging DC voltage select signal (/HV1DC0), primary charging AC voltage select signal (/HV1AC0), and density adjustment signal (for primary charging voltage) (/HV1PWM) to control the high-voltage power supply. The /HV1DC1 signal and /HV1AC1 signal turn the primary charging voltage (DC, AC) on or off. The /HV1DC0 signal selects the printing bias or the between-colors bias/between-pages bias.

The /HV1AC0 signal switches the primary charging voltage AC current value according to the environment detected by the temperature/humidity sensing system. The output value of the /HV1PWM signal remains fixed.

		/HV1DC0	/HV1DC1	/HV1AC0	/HV1AC1
OFF		—	H	—	H
Between-Colors Bias/Between-Pages Bias		L	L	—	H
Print Bias	AC Current : Low	H	L	H	L
	AC Current : High	H	L	L	L



For the initial rotations, IC1003 sets the /HV1DC1 signal to “L” and the /HV1DC0 signal to “L” to apply between-colors bias/between-pages bias to the primary charging roller. Then, the /HV1DC1 signal goes “L” and the /HV1AC1 signal goes “H” so that the primary charging roller is charged with the print bias with the primary charging voltage AC bias and DC bias being superimposed. For between-colors/between-pages, the /HV1AC1 signal is set to “H” and only the DC bias is applied, with the AC bias turned off.



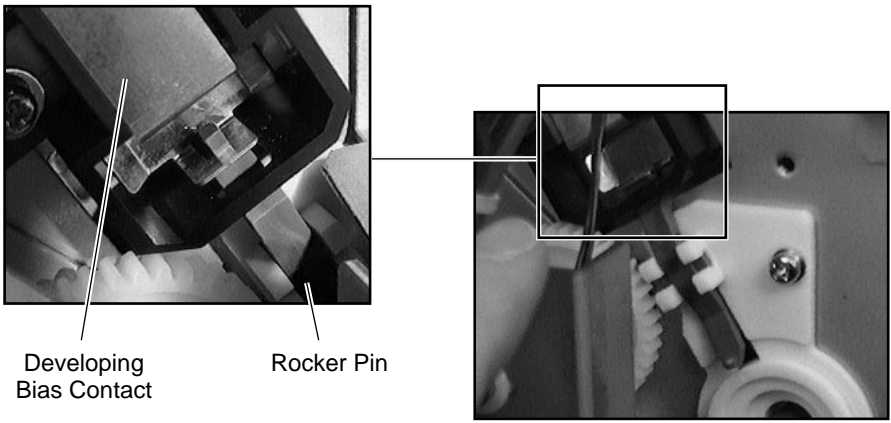
HVFre 1, 2 are signals of pulses.

## Developing Bias

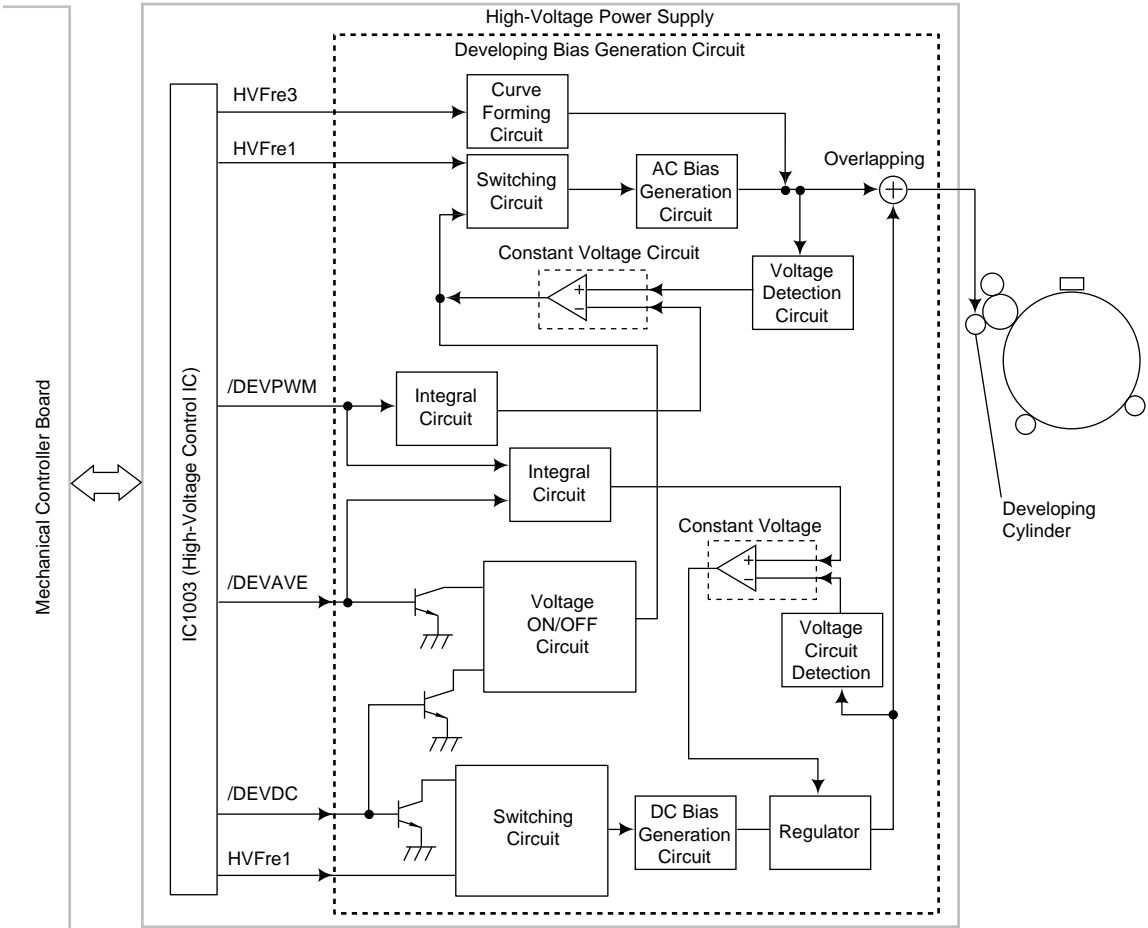
When the print sequence starts, the primary charging voltage (AC/DC) is applied and the toner cartridge is pressed against the photosensitive drum to rotate the developing cylinder. Then the high-voltage control IC (IC1003) on the high-voltage power supply board sets the developing bias DC drive signal (/DEVDC) to “L” and applies the developing DC bias to the developing cylinder through the developing bias contact behind the mechanical controller board. After the specified period of time has elapsed, the developing bias AC drive signal (/DEVAVE) goes “L” and the voltage superimposing developing AC bias onto developing DC bias is applied to the developing cylinder.

The developing bias is applied only when the toner cartridge is pressed against the photosensitive drum. Before the toner cartridge leaves the drum, the /DEVDC signal and /DEVAVE signal are set to “H” to turn off the developing bias.

**Note:** The rotation of the toner press drive gear actuates a rocker pin that opens and closes the developing bias contact. This completes the circuit to the developing cylinder that is shown on the next page. For more information, see the “Toner Carousel Assembly” topic in the Take Apart chapter.



As the density adjustment signal (for the developing bias) (/DEVPWM) adjusts image density according to density instructions from the mechanical controller, IC1003 changes the amplitude value of the developing DC bias and the developing AC bias. The /DEVPWM signal varies according to image density correction control and the setting of the density control panel.

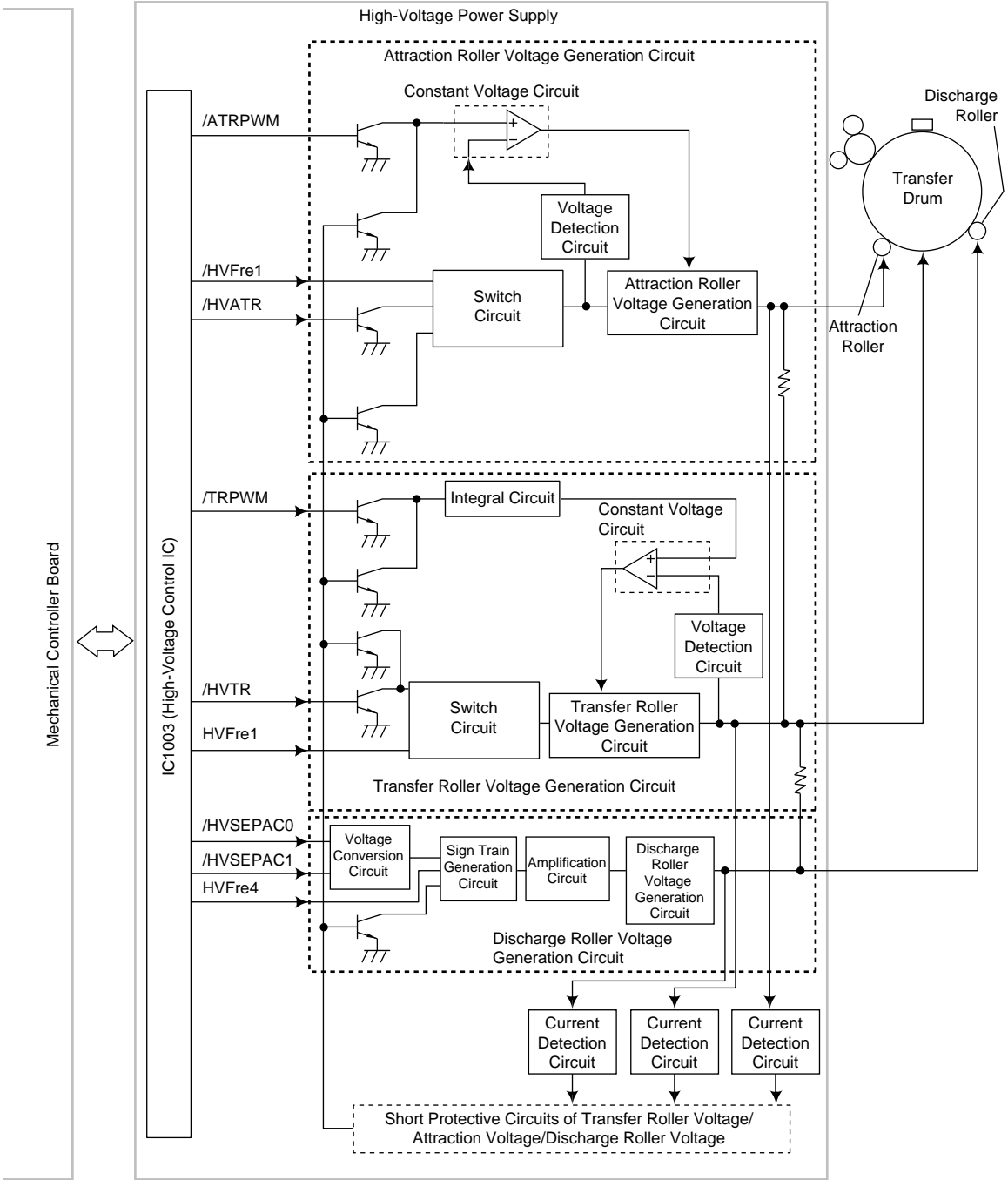


HVFre1, 3 are pulse signals.

Voltage to Transfer Drum

The transfer drum is charged with print bias and between-colors bias according to each print sequence.

For print bias, positive voltage is applied to the transfer drum in order to transfer the toner on the photosensitive drum surface onto the paper.



HVFre1, 4 are pulse signals

For full-color transfer, the transfer force weakens as the number of negatively charged toner particles on the paper increases as the transfer step proceeds with the first color, second color and so on. To counteract this effect, the transfer bias is gradually increased for the second and subsequent colors. Also, the transfer bias control signal (/TRPWM) is changed according to the temperature/humidity sensing system so as to apply an appropriate print bias.

The between-colors bias, with a voltage value smaller than that of the print bias, is applied between colors to minimize the damage to the photosensitive drum.

When the drum motor begins to rotate, the high-voltage control IC (IC1003) on the high-voltage power supply board is charged with the transfer bias by setting the transfer voltage drive signal (/HVTR) to “L.” At the same time, the print bias and between-colors bias for each color are applied by varying the /TRPWM signal.

**Voltage to  
Attraction  
Roller**

For full-color transfer, the high-voltage control IC (IC1003) on the high-voltage power supply board applies the attraction voltage to the attraction roller by setting the attraction voltage drive signal (/HVATR) to “L” before transference of the first color image. Also, an appropriate attraction bias is applied by varying the attraction bias value control signal (/ATRPWM) according to the environment detected by the temperature/humidity sensing system. After the attraction roller contacts the transfer drum for a specified period of time, the /HVATR signal is set to “H,” and the attraction bias is set to off.

**Voltage to  
Discharge  
Roller**

When the paper is separated, the high-voltage control IC (IC1003) on the high-voltage power supply board applies the discharge bias, which is output in response to the combination of the discharge bias (AC) select signals (/HVSEAC0, /HVSEAC1), to the discharge roller in order to discharge the transfer drum surface.

Based on values sensed by the temperature/humidity sensing system, the discharge bias changes the combination of the /HVSEAC0 and /HVSEAC1 signals to switch the discharge bias value.

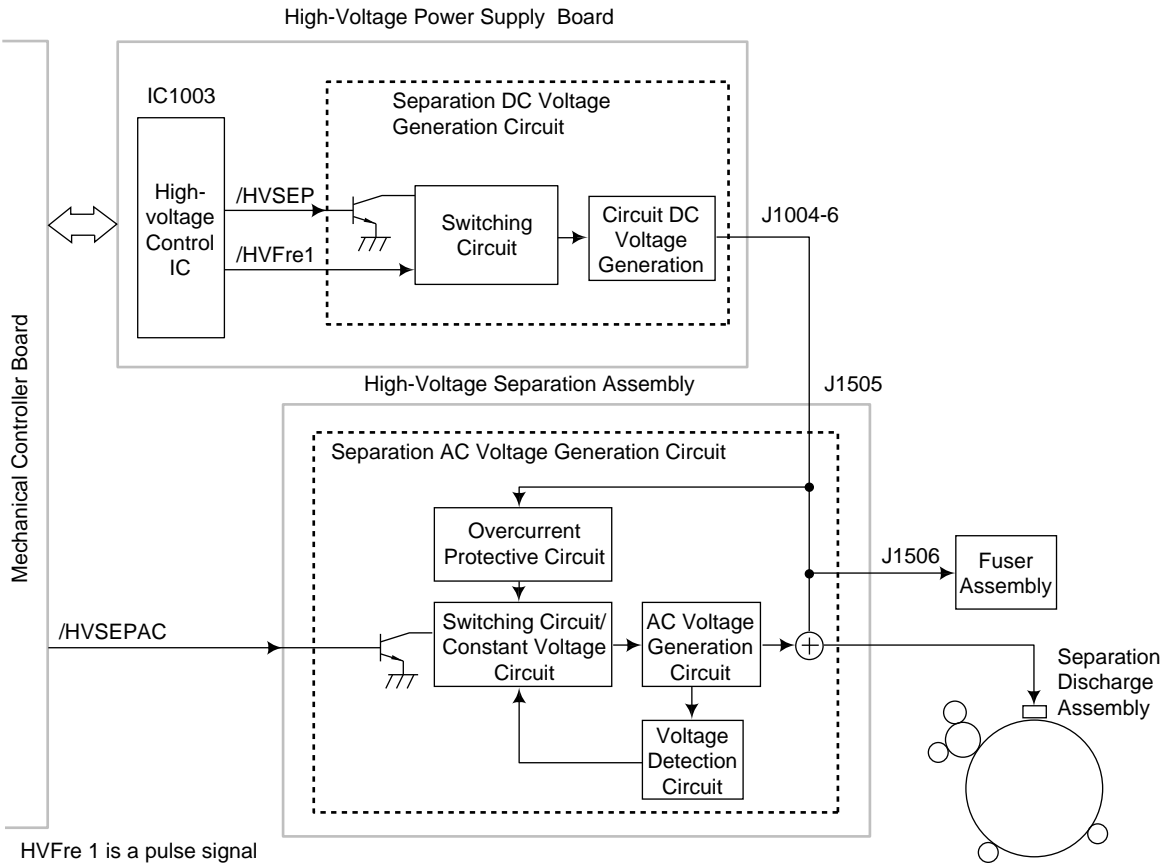
	/HVSEAC0	/HVSEAC1
OFF	H	H
Discharge Bias: Low	L	H
Discharge Bias: Middle	H	L
Discharge Bias: High	L	L

Voltage to  
Separation  
Discharge  
Assembly

Separation AC voltage is applied to the separation discharge assembly to aid in paper separation when a low temperature and low humidity environment is detected by the temperature/humidity sensing system. Separation DC voltage usually is applied to the upper fuser roller and the separation discharge assembly in print period.

The high-voltage control IC (IC1003) on the high-voltage power supply board sets the separation DC voltage drive signal (/HVSEP) to “L” and generates the voltage in the separation DC voltage generation circuit on the high-voltage power supply board. The separation DC voltage is input once to the high-voltage separation board, and applied to the upper fuser roller and the separation discharge assembly. On the other hand, when the separation AC voltage drive signal (/HVSEPA) input from the mechanical controller goes “L,” the separation AC voltage generation circuit in the high-voltage separation board generates the separation AC voltage, and applies it to the separation discharge assembly upon superimposing it onto the separation DC voltage.

**Note:** The separation discharge assembly can be forced on or off manually by means of the density control panel. See “Separation Voltage Designation” earlier in this chapter.



## Photosensitive Drum Life Detection

### Outline

The printer determines the life of the photosensitive drum mathematically by tracking page count. When a new photoconductor cartridge is installed, the EEPROM on the DC controller board logs the current page count of the printer. This value becomes the starting page count for that photoconductor. During each subsequent print, the controller compares the running page count against the starting page count stored in EEPROM. If the difference between the two values reaches a prescribed number, the controller determines that end of life has occurred and instructs the I/O controller to report the appropriate alert to the status panel.

Only new cartridges initialize page count. Otherwise, the printer would recognize as new any used cartridge that had been removed and reinstalled. This safeguard is achieved by storing a second value in EEPROM, the thickness of the photosensitive drum.

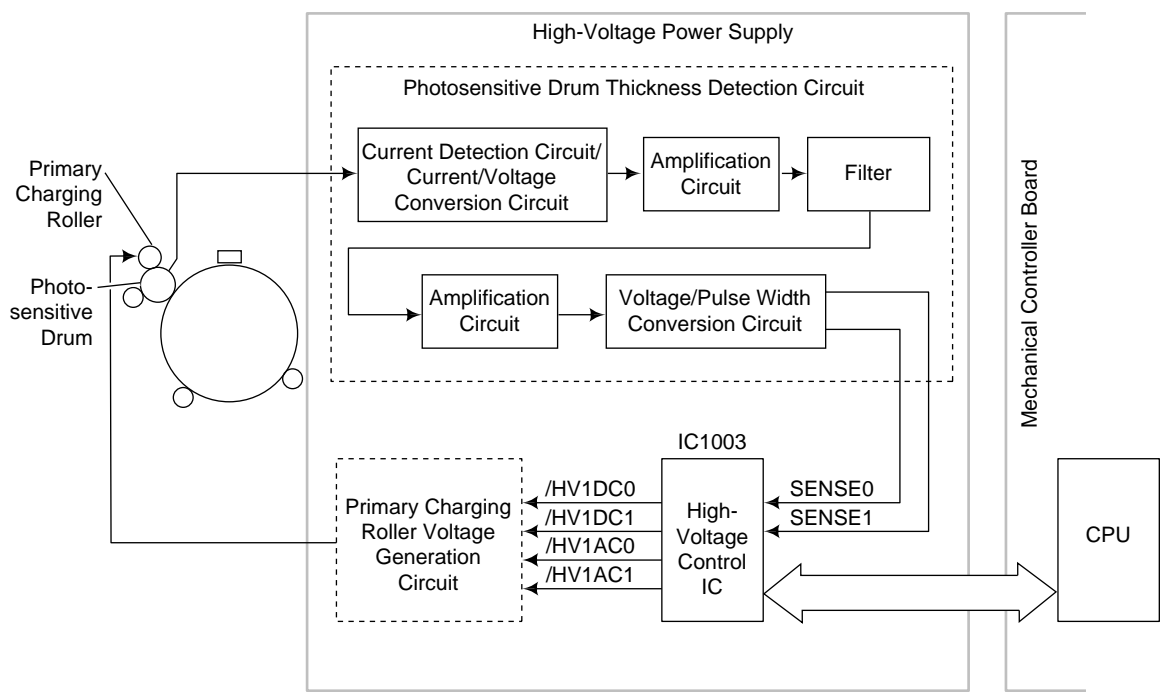
**Note:** Before replacing the DC controller board, you must download these values (see Chapter 2). If you are installing a new photoconductor and there is a chance that the old one will be reinstalled, as a troubleshooting measure for example, you must also download these values.

### Drum Thickness Detection

The thickness of the photosensitive drum is detected upon power-on, door-open, and each time a certain number of prints is reached. Drum thickness is detected by measuring the discharged current value after charging by the primary charging roller to the photosensitive drum. For correct measurement of the current value, the photosensitive drum and the transfer drum are separated from each other and the thickness detection is performed. See “Drum Separation” below.

The photosensitive drum thickness detection circuit is in the high-voltage power supply board. After the power is turned on and the main motor is turned on, the drum press solenoid (SL7) is turned on and the photosensitive drum and the transfer drum are separated. Then the drum motor is turned on, the primary charging DC voltage drive signal (/HV1DC1) and the primary charging AC voltage drive signal (/HV1AC1) are set to “L,” the primary charging AC voltage select signal (/HV1AC0) is set to “L,” and the primary charging DC voltage select signal (/HV1DC0) is set to “H” to apply the primary charging voltage to the photosensitive drum.

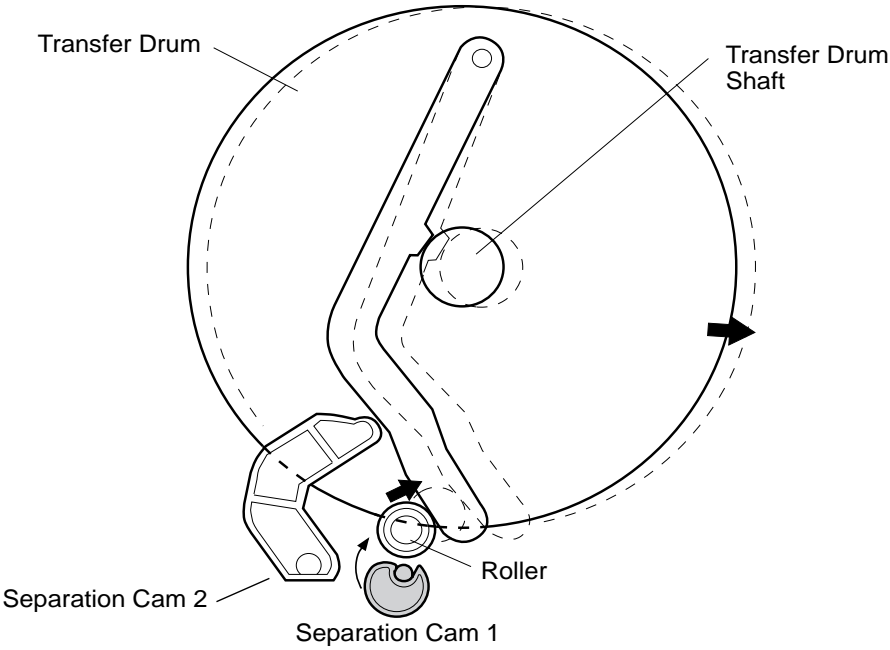
After charging for a specified period of time, the /HV1DC1 signal is set to “H,” the application of the primary DC voltage is stopped, and the discharging current value is measured by the photosensitive drum thickness detection circuit on the high-voltage power supply board. The measured current value is sent from the high-voltage control IC to the mechanical controller as the drum thickness sense signals (SENSE0 and SENSE1). The mechanical controller converts these signals into the corresponding time data and sends them to the DC controller. Based on these signals, the CPU on the DC controller determines whether the photoconductor cartridge has been replaced with a new one and whether the photoconductor is installed in the printer.



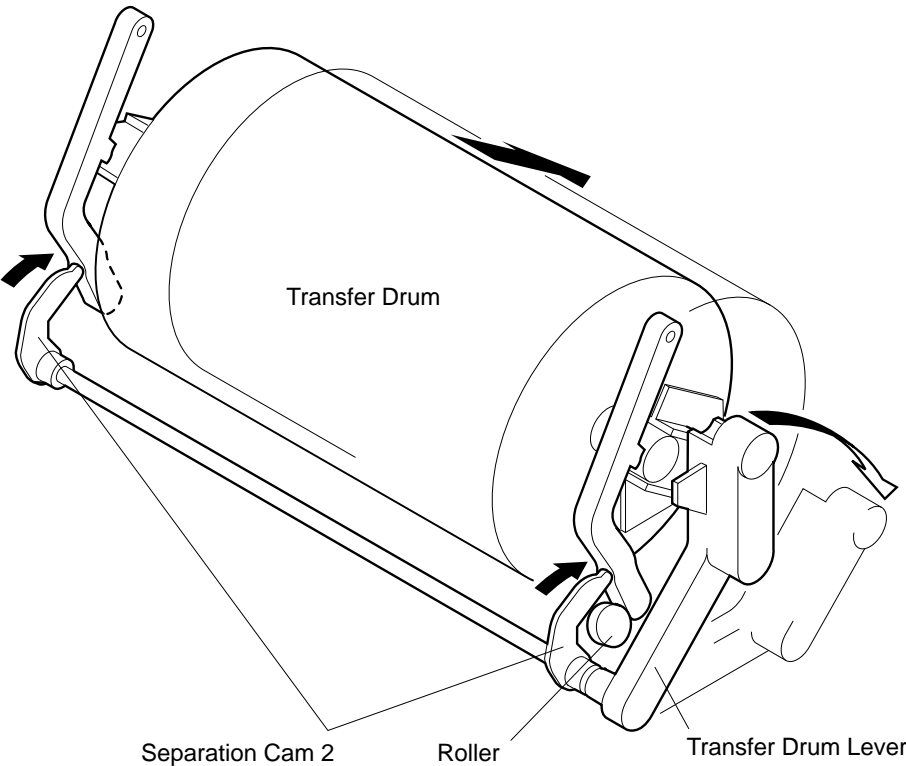
**Drum Separation**

The photosensitive drum and the transfer drum are separated when the photosensitive drum thickness detection is performed, the overhead-transparency mode is activated, or the photoconductor cartridge is being replaced. When the mechanical controller sets the drum press signal (/DDSLON) to “L,” the drum press solenoid (SL7) is turned on and drum separation cam 1 activates to move the transfer drum away from the photosensitive drum.





When you lower the transfer drum lever, drum separation cam 2 moves the transfer drum away from the photosensitive drum in a manner identical to the solenoid-controlled operation described above.



## Toner Carousel Control: Outline

The toner carousel consists of four cylindrical bays clustered around a central press assembly. Each bay is occupied by a single cartridge.

### Fetch

When you load a cartridge into the printer, that color is said to be in a “fetch” position. As the cartridge clicks into place, nine separate pins engage. These pins assure a solid coupling that is critical to the mechanical functionality of the printer. See “Toner Cartridge Installation” for more information.

**Note:** The “home” position of the carousel is the same as the magenta “fetch” position. This is the position of the carousel during standby.

### Stop

During printing or startup, the carousel rotates counterclockwise to bring the cartridge to a position facing the photosensitive drum. This is known as the “stop” position. From the fetch to the stop positions, the cartridge housing revolves approximately 135 degrees relative to the inner workings of the cartridge. Therefore, the developing cylinder is fully exposed at the stop position. It has not yet meshed with a drive train. See “Toner Cartridge Stop” in the “Carousel Rotation” section for more information.

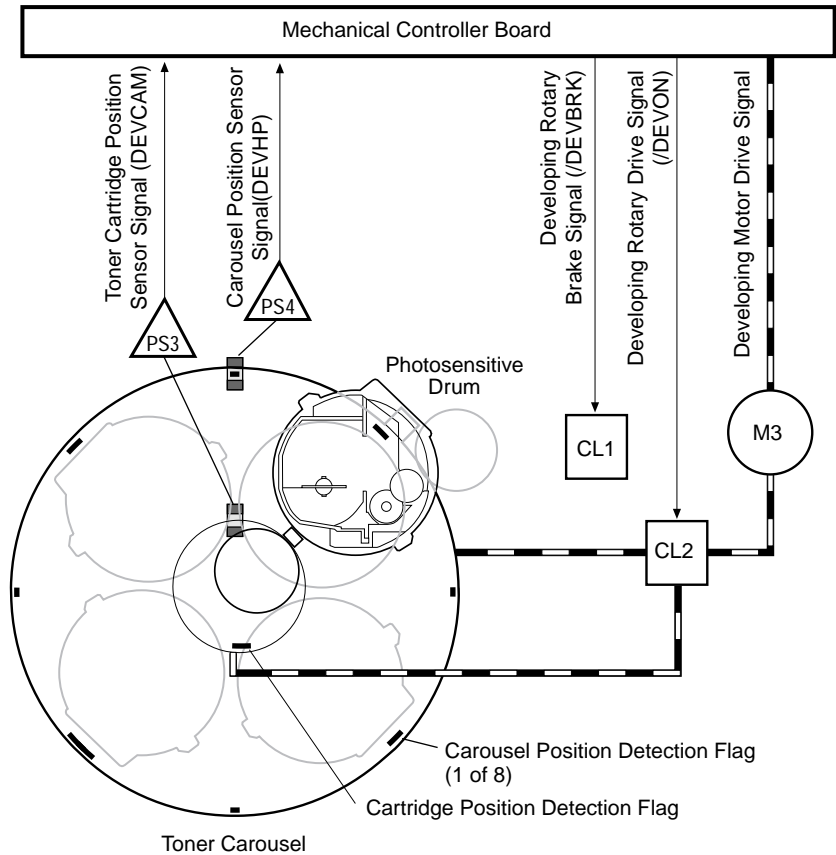
### Press

The cartridge press assembly at the center of the carousel keeps its position relative to the chassis and does not rotate with the carousel.

The moment the cartridge reaches a stop position, the press assembly shifts it laterally and presses its developing cylinder against the photosensitive drum. This is known as the “press” position and is the only stage in which the inner workings of the cartridge are mechanically driven. Press occurs first for magenta, followed in order by cyan, yellow, and black.

See “Toner Cartridge Press” in the “Carousel Rotation” for more information.

Mechanical drive is delivered to the toner carousel in three phases: the rotation of the toner carousel itself, the press and separation of the toner cartridge, and the rotation of the developing cylinder. This sequencing is accomplished by varying the rotational direction of the toner carousel motor and the switching of the toner carousel drive clutch (CL2). The three phases are delivered from three separate points on the printer drive assembly.

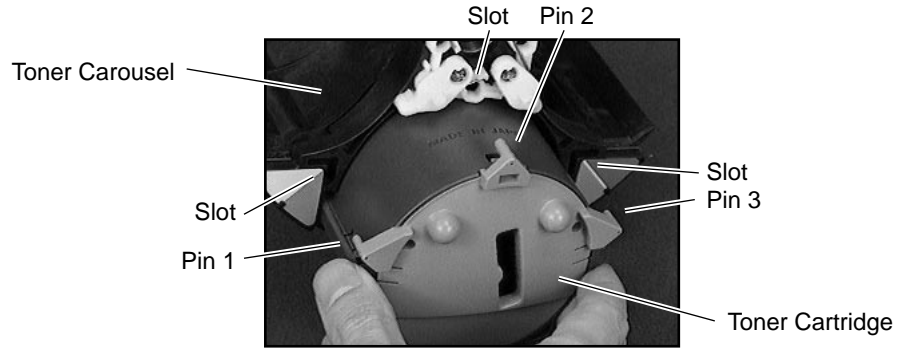


	Toner Carousel Motor	Toner Carousel Clutch (CL2)
Carousel Rotation	Normal	On
Toner Cartridge Press/Separation	Reverse	Off
Developing Cylinder Rotation	Normal	Off

Toner Cartridge Installation

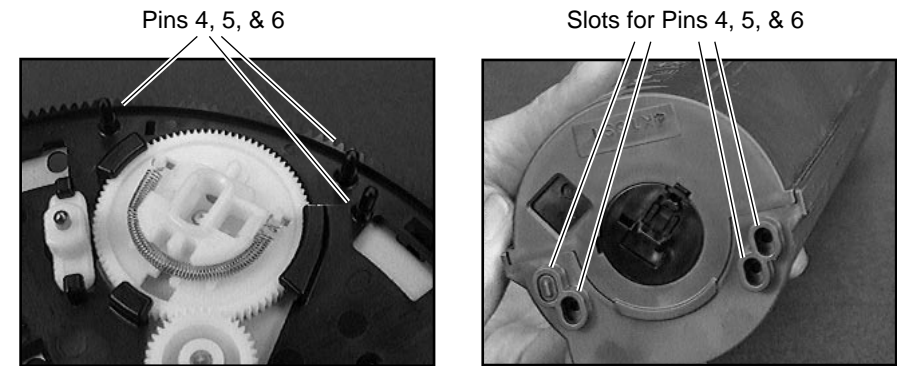
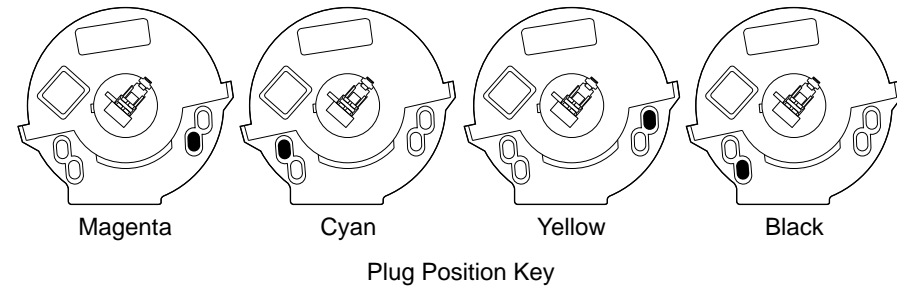
Pins  
1, 2, 3

The front face of the toner cartridge has three triangular projections on which positioning pins are mounted. Pins 1 and 3 on the sides mate into the hard plastic of the carousel. Pin 2 on the top mates into a white nylon bushing. These pins help fix the cartridge housing to the carousel in a rotational axis, while still allowing for the slight lateral press that occurs during development. The slot for pin 2 is spring-loaded and also assists in cartridge separation after development.



Pins  
4, 5, 6

There are three toner-color identification pins projecting from the carousel end panel. The arrangement of pins is unique for each bay. These pins mate into three slots on the rear face of the cartridge. A fourth slot on each cartridge is plugged to prevent the cartridge from being installed into an incorrect bay.

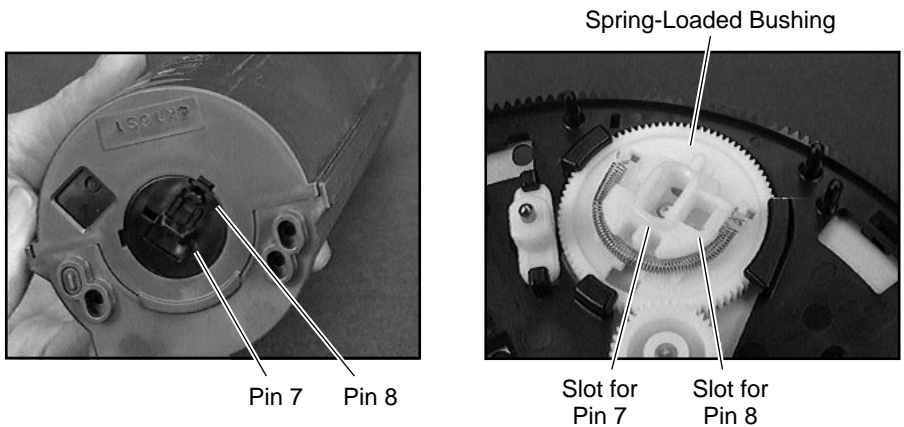


Pin and plug positions are unique for each color. This example shows the cyan bay and cartridge.

**Pins  
7, 8**

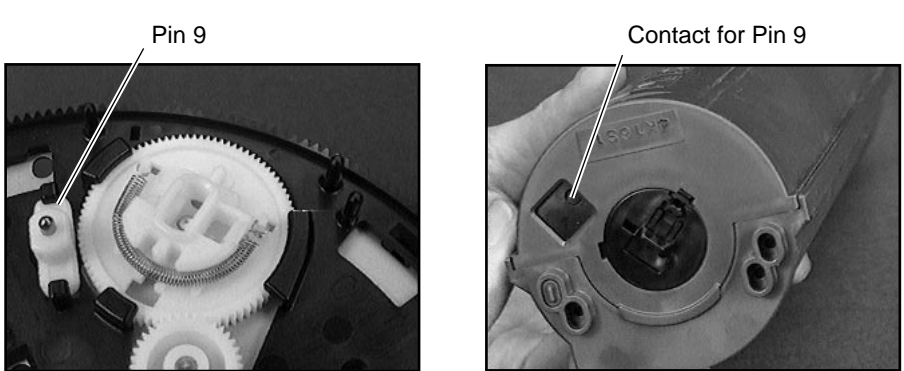
The 3/8" (95 mm) wide pin 7 at the center-point of the cartridge mates into a slot in a spring-loaded bushing in the carousel end panel. This pin functions similarly to pin 2.

Pin 8 is the flex-type pin on the rear face of the cartridge. It mates into a slot in the same bushing as pin 7 described above, but its function is entirely different. A ramped opening into the slot actuates pin 8 and unlocks the toner cartridge so that its inner workings rotate independently of its outer housing. This design accomplishes two things: it keeps toner plumb so as to avoid scattering that would otherwise occur; and it reveals the developing cylinder in synch with a cartridge's arrival at the "stop" position.



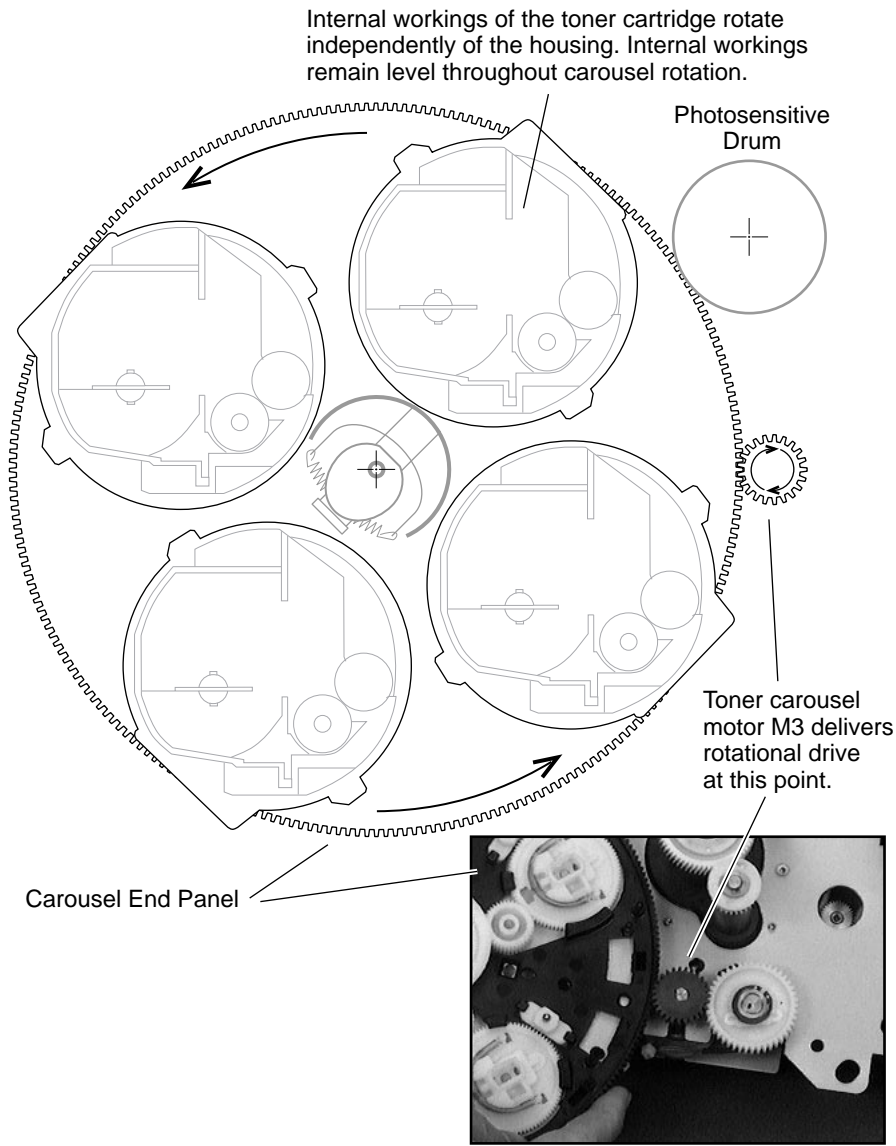
**Pin 9**

The developing bias transfer pin on the carousel end panel presses against the contact inside the rear face of the cartridge.



Carousel Rotation

The carousel rotates to advance the next toner cartridge to the photo-sensitive drum.



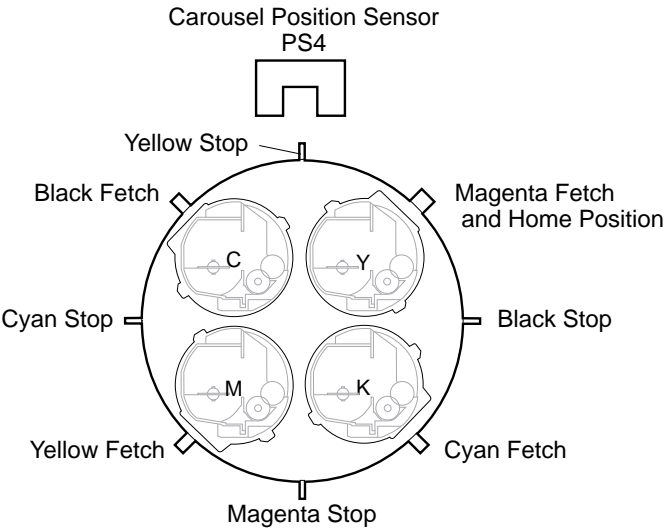
When the print sequence command is received from the DC controller, the mechanical controller sets the developing rotary brake signal (/DEVBRK) to “H,” and the toner carousel brake clutch (CL1) to off to release the brake. At the same time, the developing rotary drive signal (/DEVON) is set to “L” and the toner carousel drive clutch (CL2) is turned on. Then the toner carousel motor starts driving the rotation of the toner carousel.

The rotational position of the toner carousel is detected by the toner carousel position sensor (PS4) by monitoring the number of passing flags (see “Carousel Rotational Position Detection” below).

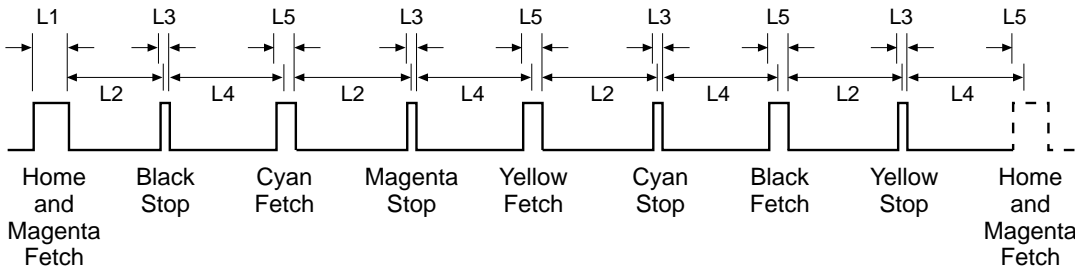
Carousel  
Rotational  
Position  
Detection

The rotational position of the toner carousel is detected by the toner carousel position sensor (PS4) by monitoring the number of passing rotational position flags. The eight rotational position flags include the home position flag (which also serves as magenta cartridge fetch position flag) and the fetch and stop position flags for each of three other colors. The home, fetch, and stop flags are of different widths.

When PS4 detects a flag, the developing rotary position sensor signal (DEVHP) is set to "H." The CPU on the mechanical controller recognizes which flag (the home position flag, stop position flag, or fetch position flag) is being detected based on the time during which the DEVHP signal is set to "H."



**Note:** This illustration is diagrammatic and doesn't show the flags and the sensor in their actual locations. In this example, the yellow cartridge is in the "stop" position opposite the photosensitive drum.

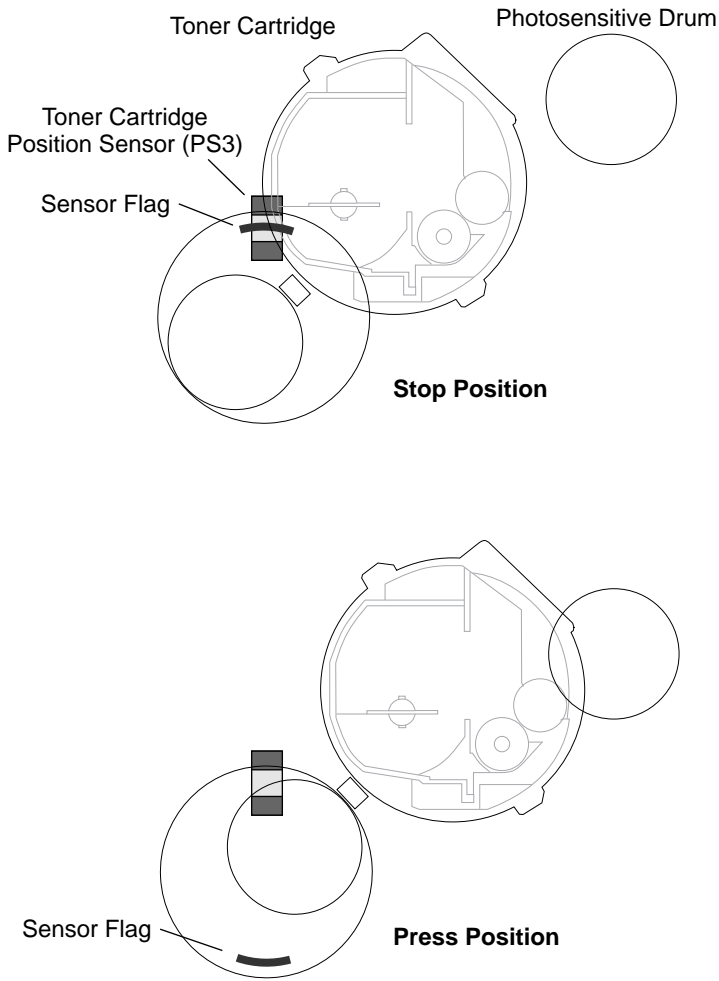


L1=Approx. 11.9 mm    L2=Approx. 62.9 mm    L3=Approx. 2.2 mm    L4=Approx. 64.0 mm    L5=Approx. 6.1 mm

Width of Flags and Distance Between Flags

Toner  
Cartridge  
Position  
Detection

The press/separation of the toner cartridge is detected by the toner cartridge position sensor (PS3) by monitoring the position detection flag. When the cartridge is separated from the drum, the flag interrupts PS3 and the toner cartridge position sensor signal (/DEV/CAM) is set to "L." When the cartridge is pressed against the drum, the flag leaves PS3 and /DEV/CAM is set to "H." The relationship between the cartridge press cam, press detection flag, and the press sensor is shown below.





**Carousel  
Rotation  
Failure**

When the following phenomena are detected by the toner carousel position sensor (PS4), the DC controller is notified by the mechanical controller and judges them as carousel rotation failures. The DC controller notifies the I/O controller of the faults and stops the printer.

- PS4 does not detect the rotational position flag even though the toner carousel motor rotates.
- PS4 detects an error in the width of the rotational position flag.
- PS4 detects a flag width differing from that of the specified rotational position flag.
- PS4 does not detect the rotational position flag when the press operation starts.

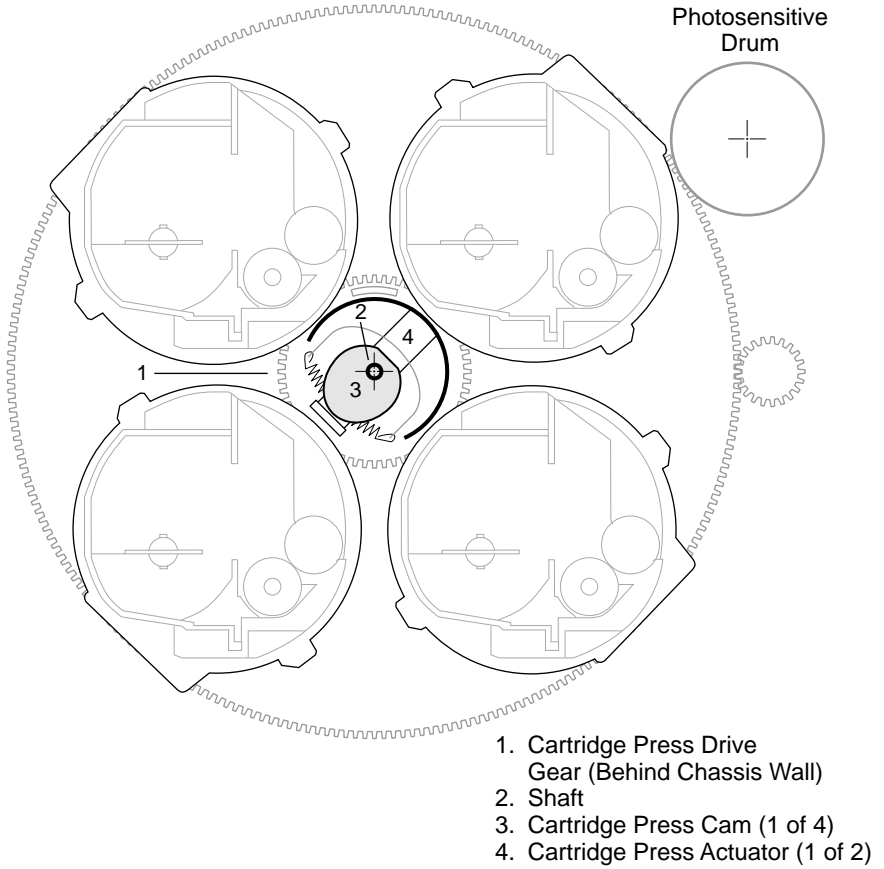
**Cartridge  
Press/  
Separation  
Failure**

When the following phenomena are detected by the toner cartridge position sensor (PS3), the DC controller is notified by the mechanical controller and judges them as toner cartridge press/separation failures. The DC controller notifies the I/O controller of the faults and stops the printer.

- PS3 stays on for a certain period of time after press starts.
- PS3 stays off for a certain period of time after separation starts.

## Toner Cartridge Stop

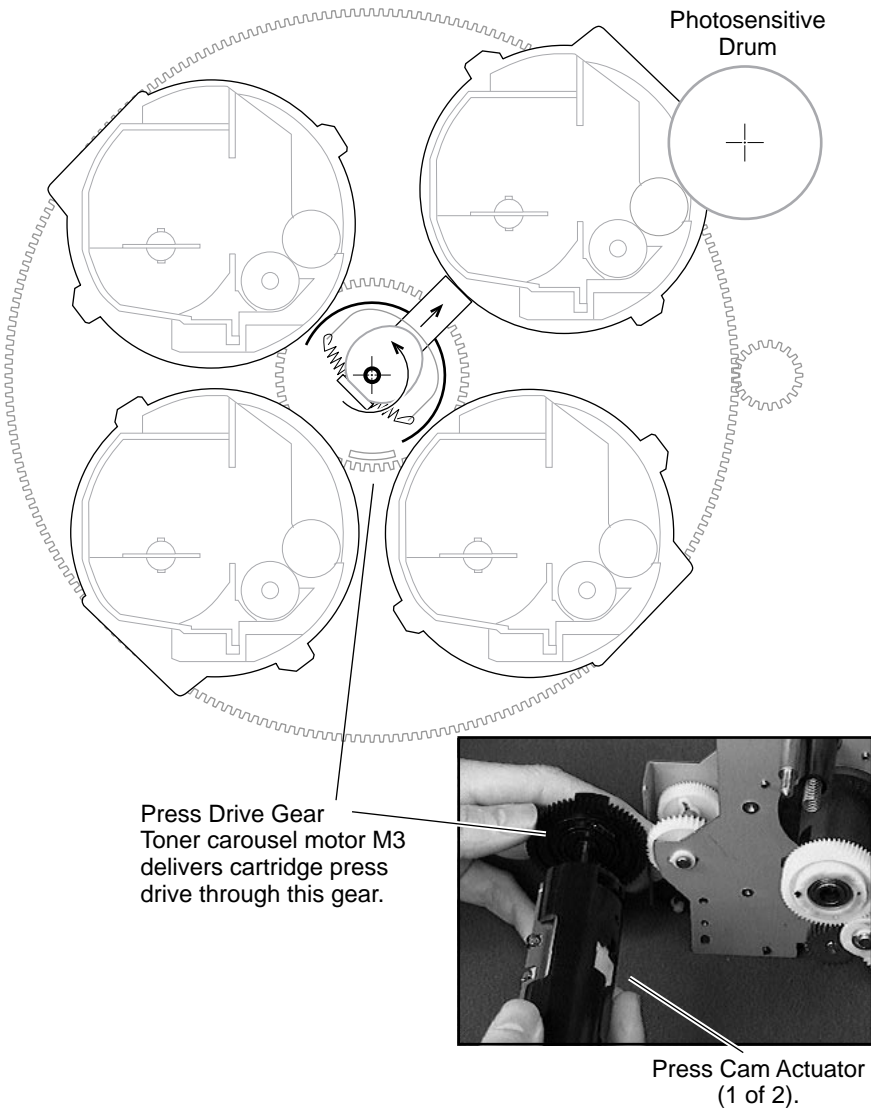
The carousel stops when the next toner cartridge is facing the photosensitive drum.



When the mechanical controller detects that the carousel has rotated to a stop position, the controller turns off the toner carousel motor. The /DEVBRK signal is set to “L,” CL1 is turned on to apply a brake, and the /DEVON signal is set to “H” to turn CL2 off.

Toner  
Cartridge  
Press

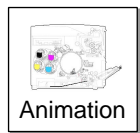
The toner cartridge is pressed against the photosensitive drum.



After the toner cartridge comes to a stop facing the photosensitive drum, the mechanical controller reverses the toner carousel motor. The cartridge press cams are driven by the toner carousel motor via the press drive gear. The four cams press the cartridge against the photosensitive drum by means of two actuators. When the cams are about to turn, the controller sets the rotary brake signal (/DEVBRK) to “H,” and turns the toner carousel brake clutch (CL1) off to release the brake.

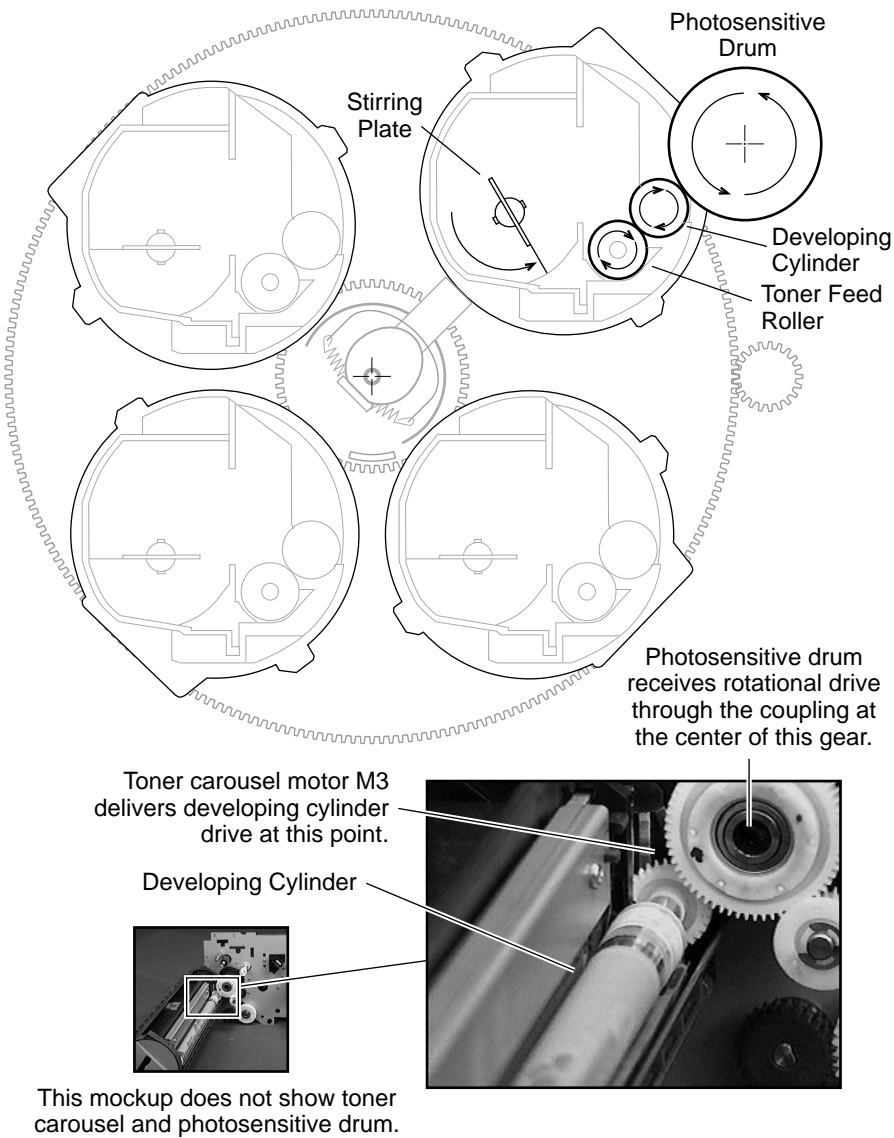
**Example:** The press cams rotate between frames 56 and 57 of the animation and press the magenta cartridge against the photosensitive drum.

When the controller detects that the cartridge has begun to leave its bay, the controller measures the amount of the drive to the pressing position, and stops the toner carousel motor according to that timing.



Developing  
Cylinder Drive

The toner carousel motor rotates the developing cylinder.



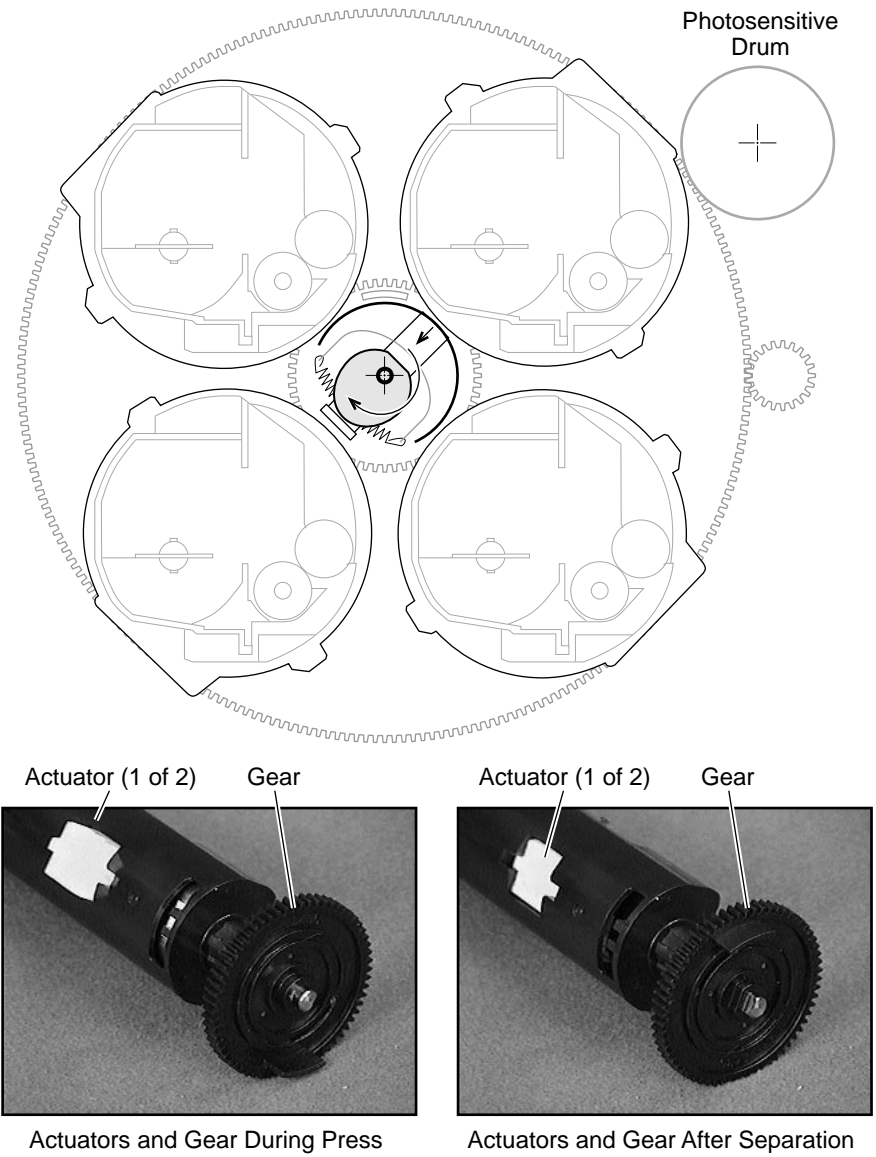
After the toner cartridge is pressed against the photosensitive drum, the mechanical controller rotates the toner carousel motor. The toner carousel motor drives the developing cylinder in the toner cartridge by means of the large white gear on the printer drive assembly into which the photosensitive drum mates.

**Note:** The photosensitive drum is driven by drum motor M3. Though the drum and carousel motors use separate drive trains, they are delivered in synch by the mechanical controller board.

Upon completion of the developing process for the designated color, the mechanical controller sets the developing rotary brake signal (/DEVBRK) to “L” and the toner carousel brake clutch (CL1) to on to apply a brake. The toner carousel motor then stops and the developing cylinder ceases to rotate.

Toner  
Cartridge  
Separation

The toner cartridge separates from the photosensitive drum after the development process.



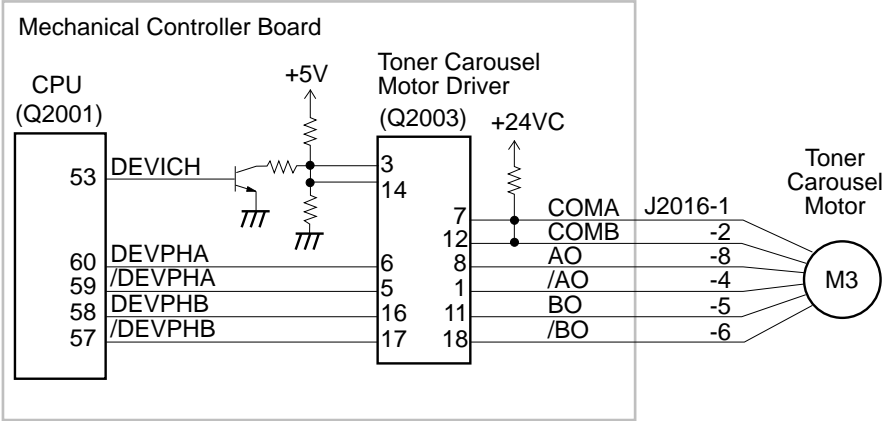
After the developing cylinder ceases to rotate, the mechanical controller reverses the toner carousel motor. This motor drives the operation of the cartridge press cam so that the pressure on the press actuator is released and the toner cartridge separates from the photosensitive drum. When the press cam is about to turn, the controller sets the developing rotary brake signal (/DEVBRK) to “H” and turns the toner carousel brake clutch (CL1) off. When the toner cartridge position sensor (PS3) detects the cartridge has begun to leave the drum, the controller sets /DEVBRK to “L” and CL1 to on again, and stops the toner carousel motor.

Carousel  
Motor Drive  
Circuit

The toner carousel motor (M3) is a two-phase stepping motor. The toner carousel motor is controlled by the toner carousel motor driver (Q2003) on the mechanical controller. This motor transmits the driving force to the toner carousel and the toner cartridge press cam.

When the print sequence command is received, the CPU (Q2001) in the mechanical controller sends the toner carousel motor control signals (DEVPHA, /DEVPHA, DEVPHB, /DEVPHB) and the toner carousel motor rotation rate select signal (DEVICH) to the drum motor driver (Q2003) 0.2 second after the main motor starts. Based on those signals, Q2003 supplies the drive signal to the toner carousel motor. 24 VC is supplied for the drive power supply.

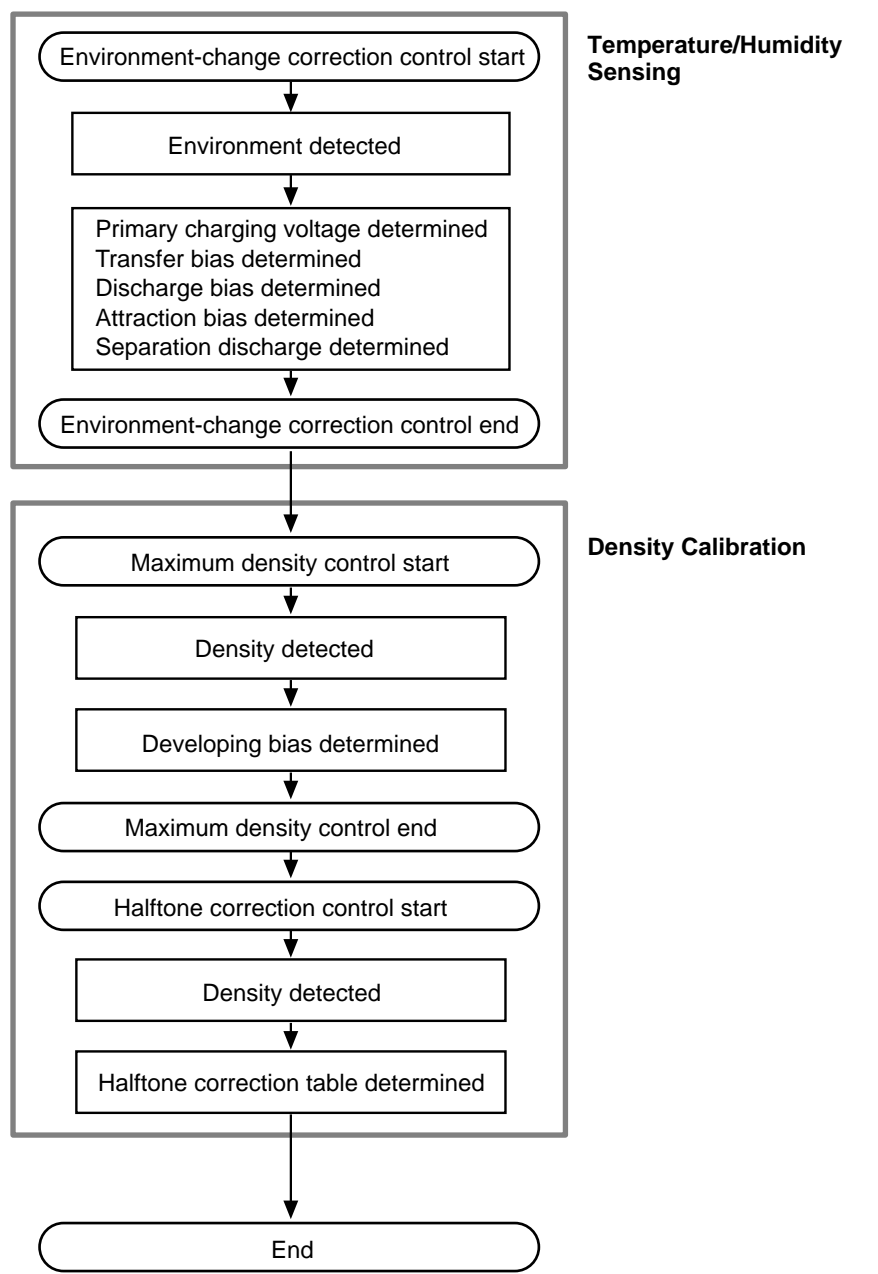
When none of the toner cartridges has been installed, exceptional rotational force is required because the carousel's center of gravity is out of center. Since the mechanical controller cannot recognize whether all cartridges are present or not during operation of the toner cartridge detection function, the CPU reduces the toner carousel rotation rate by setting the DEVICH signal to "H" to drive the toner carousel motor at half-speed.



## Image Quality Stability Control

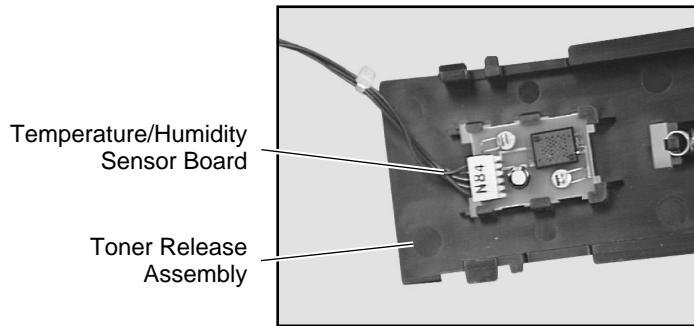
**Outline** The printer is protected by an image quality control system that minimizes image density fluctuations caused by environmental changes, photosensitive drum wear, and degradation of toner.

- Intervals** Image quality stability control is performed at the following intervals:
- When the power is turned on
  - When the printer encounters an abrupt environmental change
  - Following every 100 prints
  - When a toner cartridge is installed
  - When a new photoconductor cartridge is installed



## Temperature/Humidity Sensing System

The printer has a temperature/humidity sensor board installed under the far end of the toner release assembly.



The DC controller monitors this sensor and adjusts the following high-voltage values if a change in temperature or humidity is sensed.

- Primary charging
- Transfer bias
- Attraction bias
- Discharge AC bias
- Separation discharge

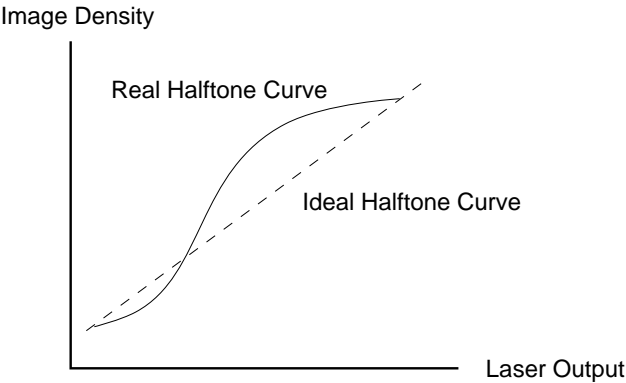
In addition to the intervals specified on the previous page, temperature/humidity sensing is performed every 30 minutes while the power is turned on.

**Note** The separation discharge value can be forced on or off manually by means of the density control panel .

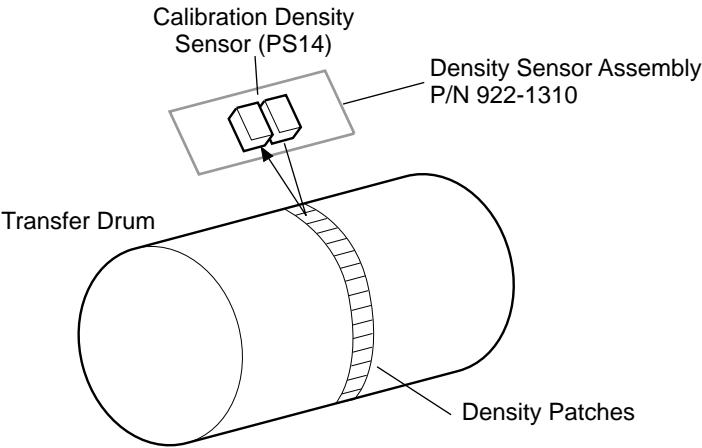


## Density Calibration System

Density Control	Maximum density control is performed to stabilize the maximum density for each color. This determines an optimum developing bias.
Halftone Correction Control	The gate array (IC109) in the DC controller contains the halftone correction table (see below) used to correct the laser output in order to obtain an ideal halftone image. The halftone correction control modifies the halftone correction table to accommodate changes in the present environment, the total number of prints, or the condition of the toner and the photosensitive drum.
Halftone Correction Table	The laser output and the image density of the printer do not change in a linear relationship. Therefore, when the laser image is output according to the halftone specified with the video data signal sent from the I/O controller, an ideal halftone image is not obtained on the actual prints. In order to obtain an ideal halftone image, the DC controller halftone correction table is used to correct the output value of the laser diode.



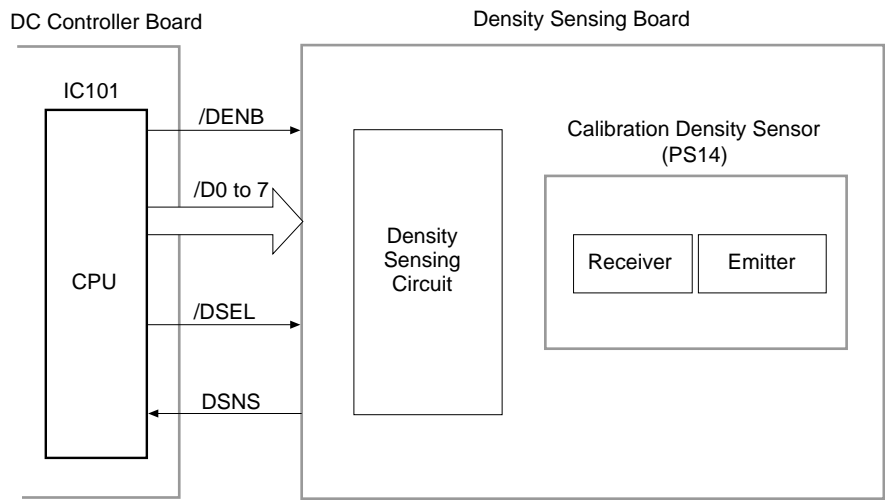
Density Circuit	Maximum density and halftone correction are controlled using the calibration density sensor (PS14).
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At each of the five intervals specified previously, the DC controller prints a series of patches directly onto the transfer drum. The light emitted by the PS14 LED is reflected off these patches and back into the photodiode of PS14.

The reflective characteristics of colored toner and black toner differ. Therefore, this sensing circuit uses the density sense mode select signal (/DSEL) to switch between the colored toner density sensing mode and the black toner density sensing mode.

When the density sense enable signal (/DENB) goes “L,” the LED emits light with the intensity provided by the LED power control signal (/D0-7). The photodiode senses the light, which is reflected by the density sensing pattern on the transfer drum. The density sensing board outputs the density to the DC controller as the toner sensor signal (DSNS).

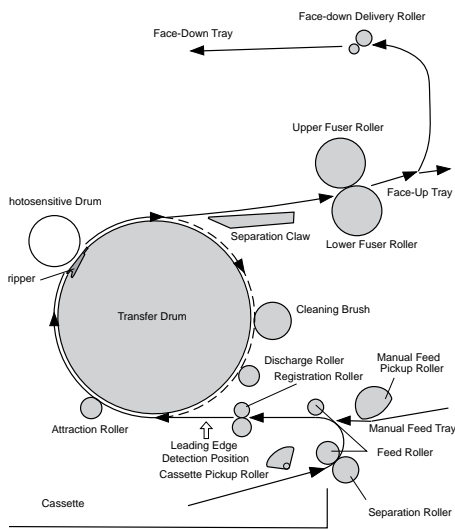


**Note:** If the DC controller determines that sensor PS14 is blocked, it will still allow printer operation to continue but will default to factory density settings.

## **V. Pickup/Feed System**

Outline

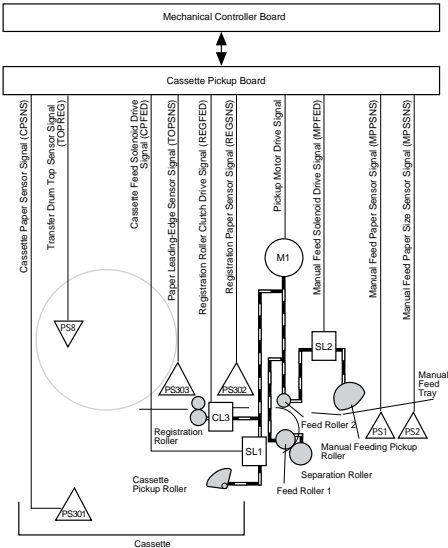
When the /PRNT signal is sent to the DC controller by the I/O controller and the scanner motor is put in the ready state, the DC controller issues the print sequence command to the mechanical controller, which then starts printing. After a sheet of paper is picked up by either the cassette or the manual feed pickup rollers, the feed rollers advance it to the registration roller, which corrects any skew. The paper then feeds a short distance to the leading edge detection position, where it pauses to synchronize with the rotation of the transfer drum. The paper then continues through the transfer, separation, and fuser, and is delivered to the face-down or face-up tray.

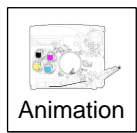


Cassette Feeding

## Paper Pickup

When the print sequence command is received, the mechanical controller drives the main motor (M2) and, 0.2 second later, also drives the drum motor (M4) and the pickup motor (M1). Simultaneously, the pickup solenoid (SL1) is turned on and the drive of the pickup motor is transferred to the pickup roller, feed rollers, and separation roller. After any multifeed pickup is eliminated by the separation roller, the paper is fed into the printer by the rotations of feed rollers 1 and 2.





The three sensors described below govern paper feed from the cassette. PS302 and PS303 are also active in print cycles originating from the multipurpose tray or optional sheet feeder. Each of these sensors is contained on the cassette pickup board (P/N 922-1311). Two are reflector type sensors and one is a conventional photo-interrupter sensor.

### **PS301 (Photo-reflector)**

The presence of paper in the cassette is detected by the cassette paper sensor (PS301).

**Example:** The animation shows the paper path for the final sheet of paper in the cassette. Up through frame 57, the light emitted from PS301 reflects off the paper and back to PS301. When the trailing edge of the last sheet of paper passes this beam in frame 58, the beam projects through a cutout in the cassette elevator plate and is no longer reflected back to PS301.

### **PS302 (Photo-interrupter)**

After actuating the lever for the registration paper sensor (PS302), the paper reaches the registration roller. Since the registration roller is not rotating at this time, the paper stops, its leading edge is curled, and its skew is corrected.

**Example:** The paper actuates the lever for PS302 and reaches the registration roller in frame 19 of the animation.

### **PS303 (Photo-reflector)**

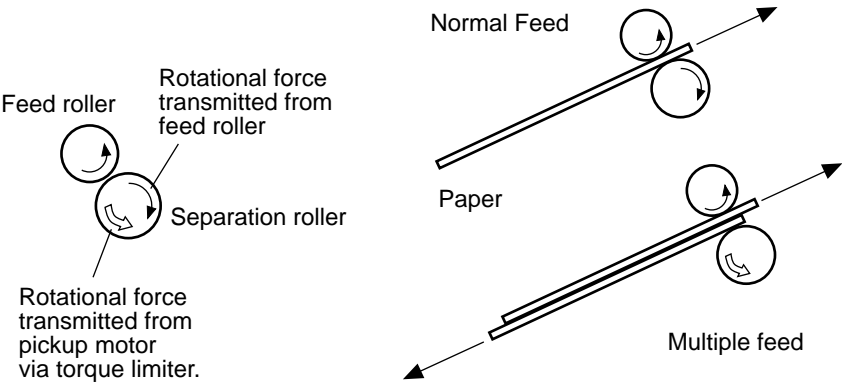
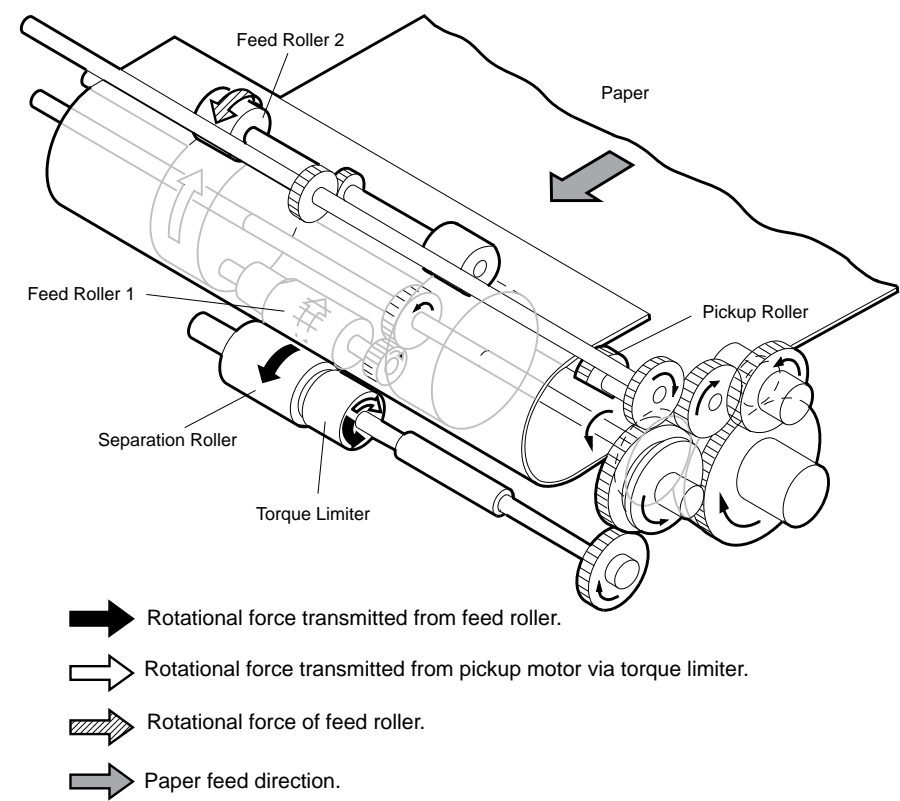
When a certain time period elapses after the paper has passed through PS302, the registration roller clutch (CL3) is turned on to resume feeding the paper. When the paper reaches the paper leading-edge sensor (PS303), the pickup motor and paper stop.

**Example:** Up through frame 38, the light emitted by PS303 reflects off a prism and returns to PS303. The leading edge of the paper breaks this beam in frame 39.

The DC controller and the mechanical controller detect the registration position on the transfer drum by the transfer drum top sensor (PS8). This timing is used as reference to execute the print sequence. The mechanical controller starts driving the pickup motor at a certain time period after detecting the registration position of the transfer drum. Thus, the paper resumes feeding so that its leading edge will synchronize with the gripper on the transfer drum and also match the image leading edge on the photosensitive drum.

Multifeed  
Prevention  
Mechanism

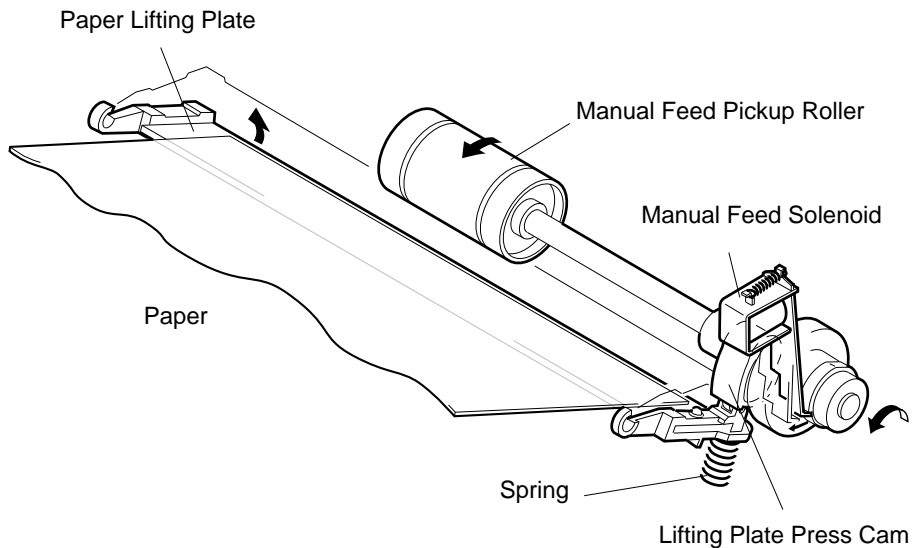
For cassette feeding, the printer uses the separation roller to prevent multifeeding. Normally, the separation roller is given rotational force reverse that of the feed roller. However, since the separation roller is equipped with a torque limiter, it rotates with the feed roller by transmission of its rotational force via the transported paper. If multiple sheets of paper are picked up, the low friction force between those sheets results in a weak rotational force being transmitted to the separation roller from the feed roller. As a result, the separation roller's own rotational force separates the extra sheet.



Manual Feeding

The presence of paper in the manual feed tray is detected by the manual feed paper-present sensor (PS1).

Upon receiving the print sequence command, the mechanical controller drives the main motor (M2) and 0.2 second later also drives the drum motor (M4) and the pickup motor (M1). After 0.5 second, the manual feed solenoid (SL2) is turned on to transmit the rotational force of the pickup motor to the manual feed pickup roller. As the pickup roller rotates, the paper lifting plate press cam is released and the spring force pushes up the paper lifting plate. Thus, the paper is pressed against the pickup roller and picked up by its rotation. After the paper is separated from any extra sheet by the separation pad, it is fed into the printer by feed roller 2. The subsequent operations are as described for cassette feeding.



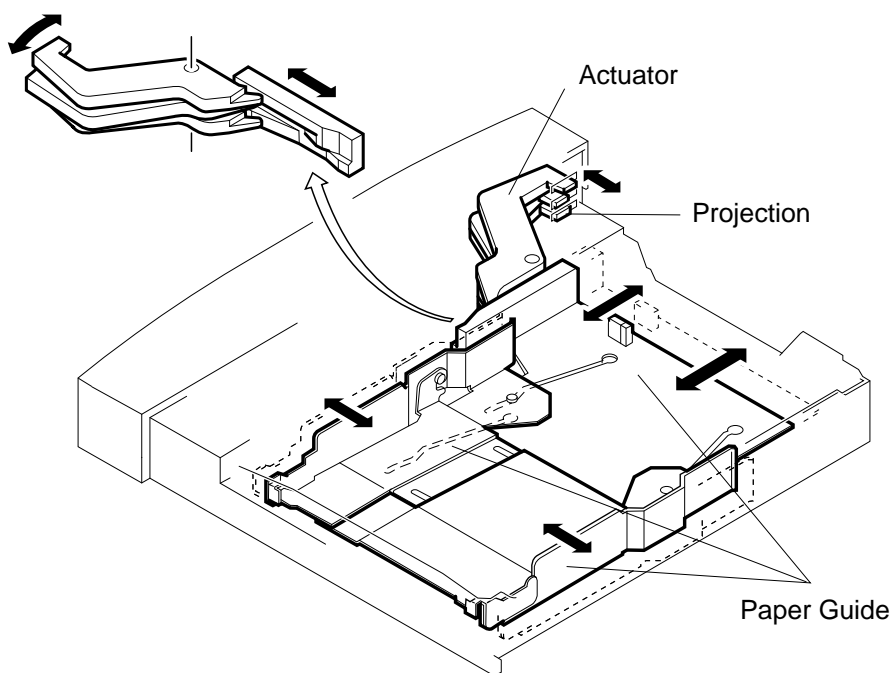


Paper Size

The paper size in the cassette is detected by the cassette size-sensing switches (CSW1, 2, and 3) on the cassette size-sensing board. Loading the cassette will turn the switches on or off as applicable. The CPU on the DC controller detects the presence of the cassette and its size by this switch combination.

Cassette	Cassette Size-Sensing Switch		
	CSW1	CSW2	CSW3
A4	OFF	ON	ON
B5	ON	OFF	ON
LTR	OFF	OFF	ON
LGL	ON	OFF	OFF
Cassette Absent	OFF	OFF	OFF

For the universal cassette, the actuators that press the cassette size-sensing switches are linked with the paper guide in the cassette. When the paper guide is set to the paper size, the positioning of projections changes accordingly.



**Note:** If the toner release handle is pulled out, the ejection sensing switch (SW1601) is turned on. The DC controller will set all the cassette size signals (/CSIZE1, /CSIZE2 and /CSIZE3) to “L” regardless of the cassette size that is installed. When the DC controller detects that the toner release handle has been pulled out, it will perform image quality stability control after the front door is closed.

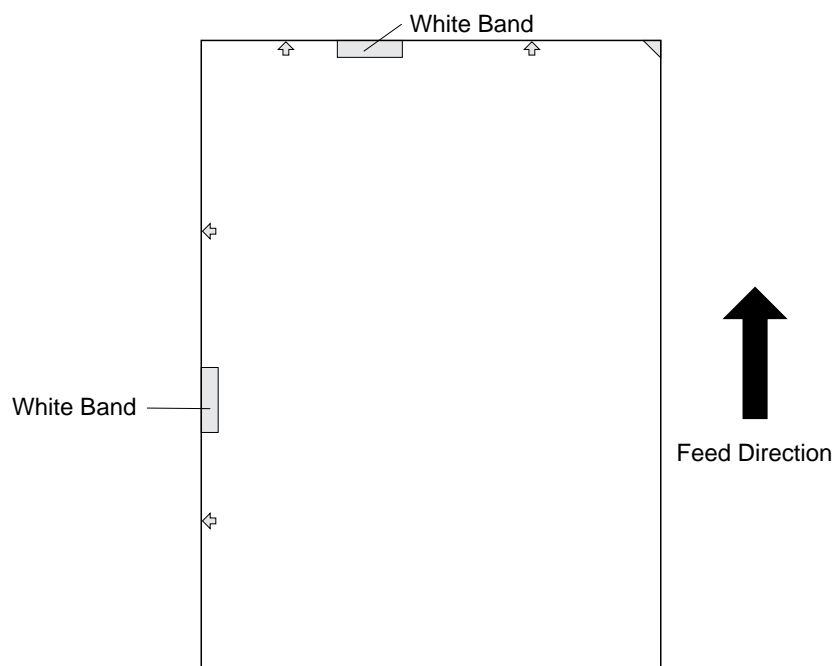
## Overhead Transparency Detection

When you use overhead transparency material for this printer, you must use the type with a white band at its leading edge. The printer makes the following determinations by measuring the period that the paper leading-edge sensor (PS303) is interrupted by this band:

- Whether it is the correct type of transparency, another type of transparency, or paper
- Whether it is placed with the proper side up
- Whether it is placed with the proper edge leading

**Note:** The band and arrows on the left side of the transparency are not used in this printer. All markings disappear during the fusing stage.

If any nondedicated transparency is used or the dedicated transparency sheet is placed incorrectly in the tray, the mechanical controller will notify the DC controller, which will stop the printer and notify the I/O controller of a nondedicated transparency jam.

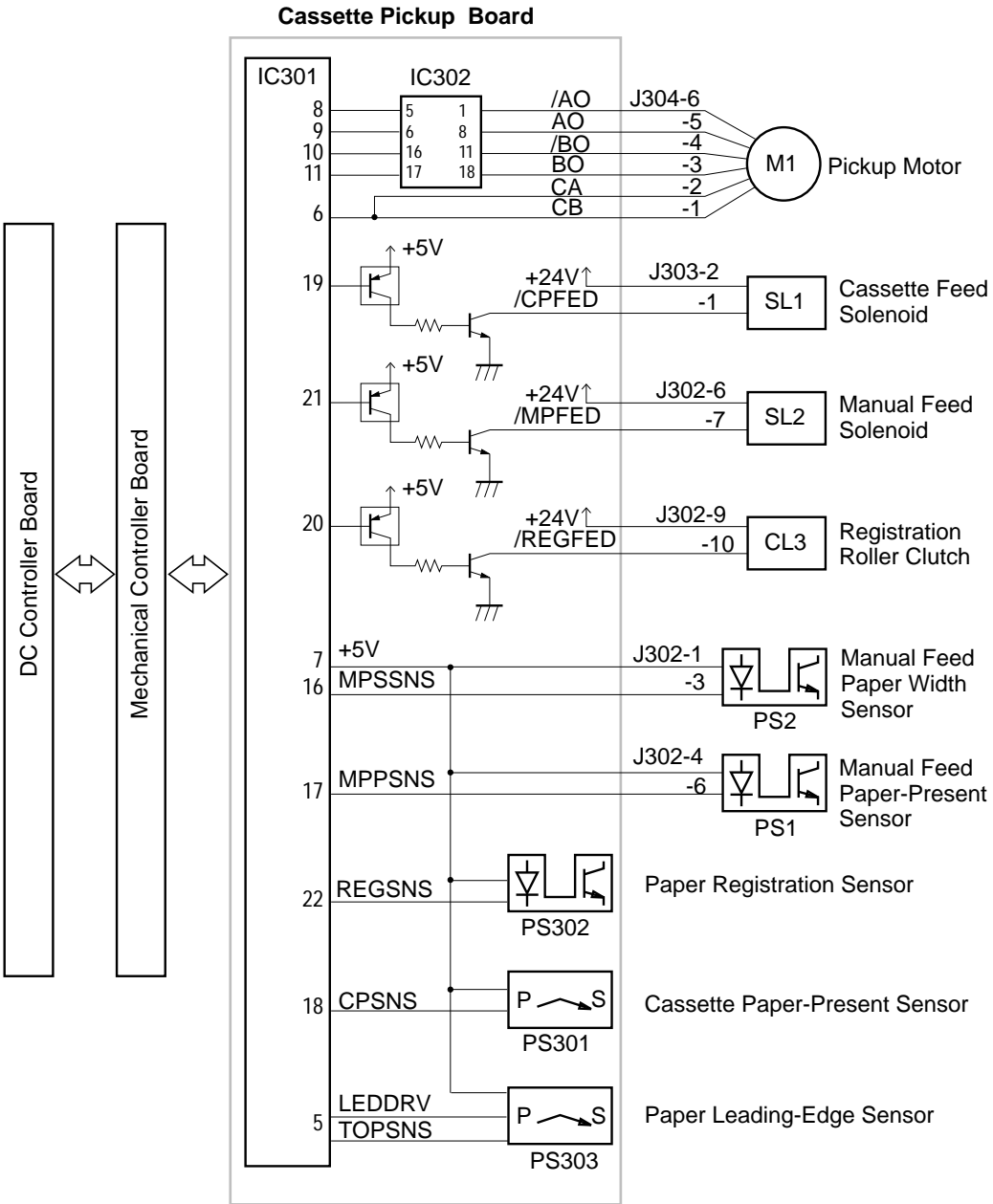


The paper leading-edge sensor is a reflective type sensor. In order to prevent sensor malfunction due to LED deterioration, the printer detects the intensity of light emitted by the LED during the initial rotations. The cassette pickup board sets the detection level based on the intensity detected. The emission level of the LED of the sensor is changed in two steps using the LED power select signal (LEDDRV). If it detects that the intensity is low due to the deterioration of the LED, IC301 will change the LEDDRV signal to increase the intensity.

## Cassette Pickup Board

The cassette pickup board carries out serial communication with the mechanical controller to control the pickup operation.

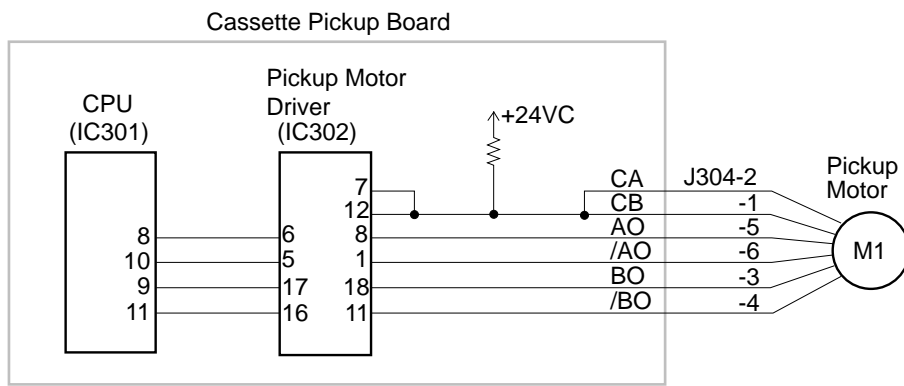
<b>IC301</b>	Controls communications with the mechanical controller and the operation of the cassette pickup board.
<b>IC302</b>	Controls the operation of the pickup motor.
<b>PS301</b>	Cassette paper sensor. When there is no paper in the cassette, the cassette paper sensor signal (CPSNS) goes “H.”
<b>PS302</b>	Registration paper sensor. This sensor is located on the feed side of the registration roller. When paper is detected, the registration paper sensor signal (REGSNS) goes “L.”
<b>PS2</b>	Manual feed paper-width sensor. When paper on the manual feed tray is B5 or smaller, the manual feed paper size sensor signal (MPSSNS) goes “H”; when it is larger than B5, the signal goes “L.”
<b>PS1</b>	Manual feed paper-present sensor. When there is no paper on the manual feed tray, the manual feed paper sensor signal (MPPSNS) goes “H.”
<b>PS303</b>	Paper leading-edge sensor. This sensor is located on the feed side of the transfer drum. When paper is detected, the paper-top sensor signal (TOPREG) goes “H.” For a transparency, the signal remains “H” only while the white band on its leading edge is being detected. The intensity of light may be changed using the LED power select signal (LEDDRV) described on the previous page.
<b>M1</b>	Pickup motor. This is a two-phase stepping motor.
<b>SL1</b>	Cassette feed solenoid. This solenoid controls the transmission of rotational drive from the pickup motor to the cassette pickup roller. When the cassette feed solenoid drive signal (/CPFED) goes “L,” the solenoid is turned on.
<b>SL2</b>	Manual feed solenoid. This solenoid controls the transmission of rotational drive from the pickup motor to the manual feed pickup roller. When the manual feed solenoid drive signal (/MPFED) goes “L,” the solenoid is turned on.
<b>CL3</b>	Registration roller clutch. This clutch controls the transmission of rotational drive from the pickup motor to the registration roller. When the registration roller clutch drive signal (/REGFED) goes “L,” the clutch is engaged.



Pickup Motor  
Drive Circuit

The pickup motor is a two-phase stepping motor located in the pickup block. This motor drives the cassette pickup roller, the manual feed pickup roller, the separation roller, the registration roller, feed rollers 1 and 2, and the paper lifting plate press cam.

The pickup motor is controlled by the pickup motor driver (IC302) on the cassette pickup board. IC302 sets the pickup motor drive signal to “L” to drive the main motor 0.2 second after starting it. IC302 selects the rotational speed as the normal speed, the initial speed, or the grip speed. Grip speed is one-third of normal speed.



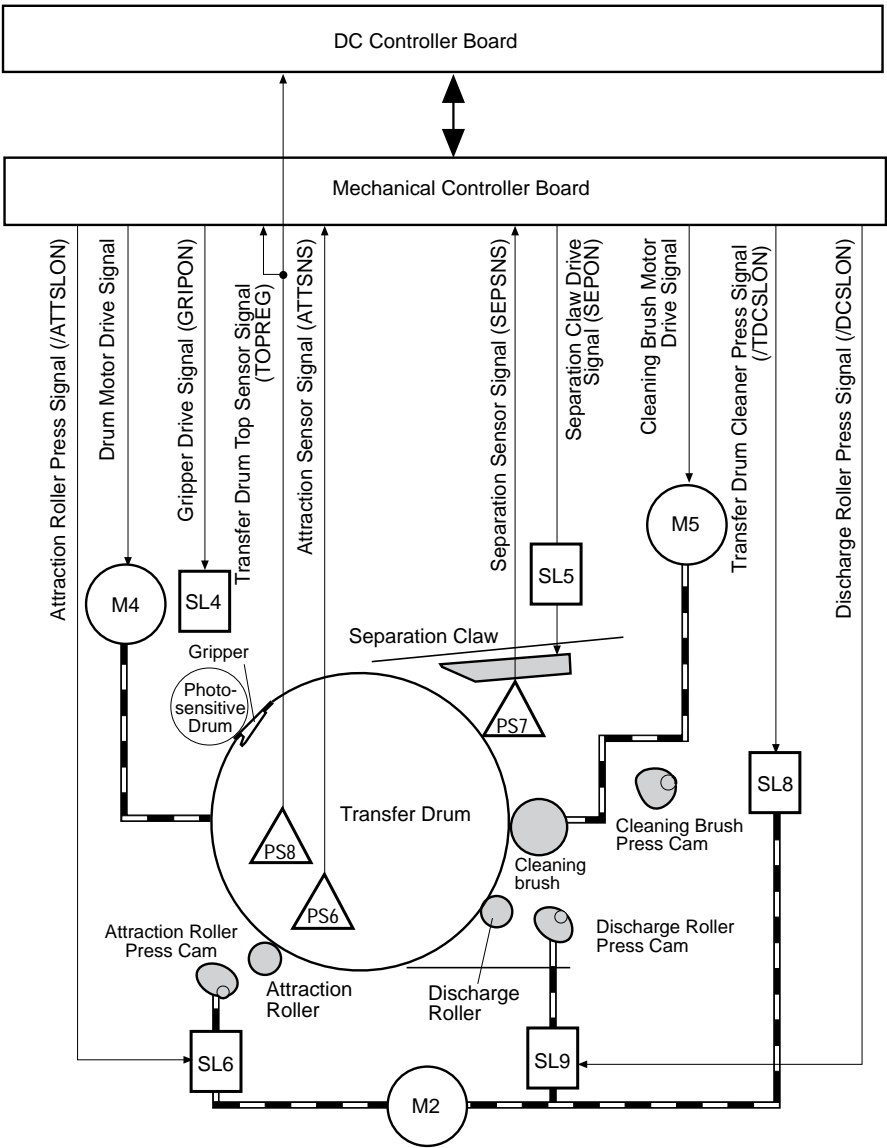
**Note:** The pickup roller rotates to the initial position upon power-on and door-open/close.

Transfer Drum and Peripherals

**Outline**

The transfer drum is the mechanism that enables multiple-pass printing. It clamps the leading edge of the paper by means of a solenoid-actuated gripper, attracts and holds the paper to its surface, and then carries the paper past the photosensitive drum where toner transfer occurs. In full-color mode, toner transfer occurs four times per page, while in the monochrome mode transfer occurs once.

The transfer drum is surrounded by the attraction roller, the photosensitive drum, the discharge roller, the cleaning brush, and the separation claw. These components are controlled by the mechanical controller.



When the paper is cued at the paper leading-edge sensor (PS303) begins feeding, the gripper drive signal (GRIPON) goes “H” and the gripper drive solenoid (SL4) is turned on to open the gripper on the transfer drum. The paper is then fed 1.3 times faster than the transfer drum speed so that its leading edge will be pushed into the opened gripper. When the leading edge of the paper reaches the gripper, SL4 is turned off and then the gripper is closed to clamp the paper top.

Simultaneously, the attraction roller press signal (/ATTSLON) turns “L” and the attraction roller press solenoid (SL6) is turned on when the separation claw drive signal (SEPON) goes “H” in order to actuate the press cam to press the attraction roller against the transfer drum. Attraction roller voltage is applied to the attraction roller while the paper is passing through it. This gives negative electric charge to the surface of the transfer drum and thus the paper is electrostatically attracted by that surface.

After toner transfer, SL4 is turned on to open the gripper. The separation claw drive solenoid (SL5) is also turned on to actuate the separation claw. The paper is separated from the transfer drum and then fed to the fuser assembly.

If the paper fails to reach or pass through each sensor within the specified time, the CPU on the DC controller determines that a jam has occurred and notifies the I/O controller.

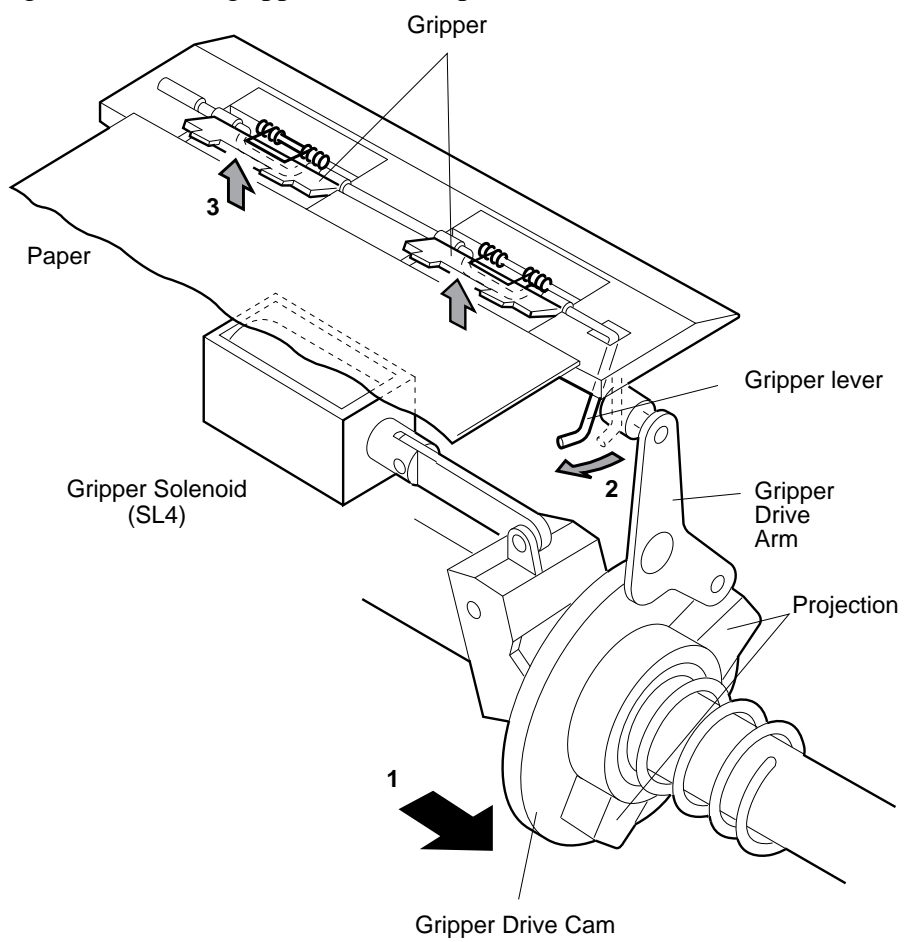


Gripper  
Control

The opening and closing of the gripper are controlled by the gripper drive signal (GRIPON) sent from the mechanical controller.

When the GRIPON signal turns “H,” the gripper solenoid (SL4) is turned on, and the gripper drive cam is pressed. Meanwhile, the gripper drive arm in the transfer drum rotates around the transfer drum shaft along with the transfer drum rotation. When the gripper arm is pressed against the cam projection, it pushes up the gripper lever to open the gripper.

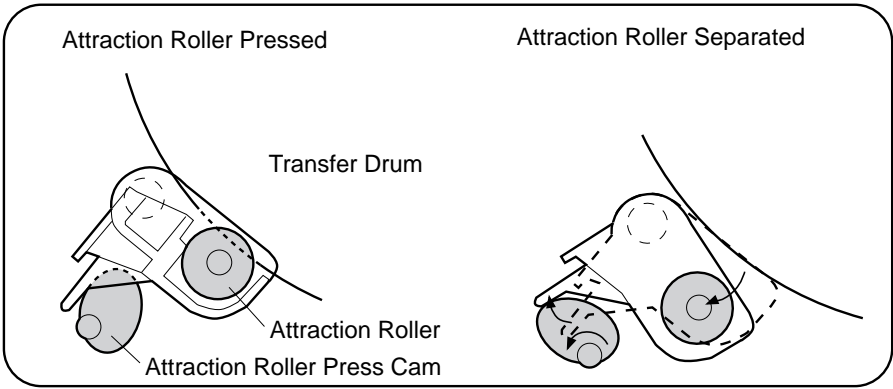
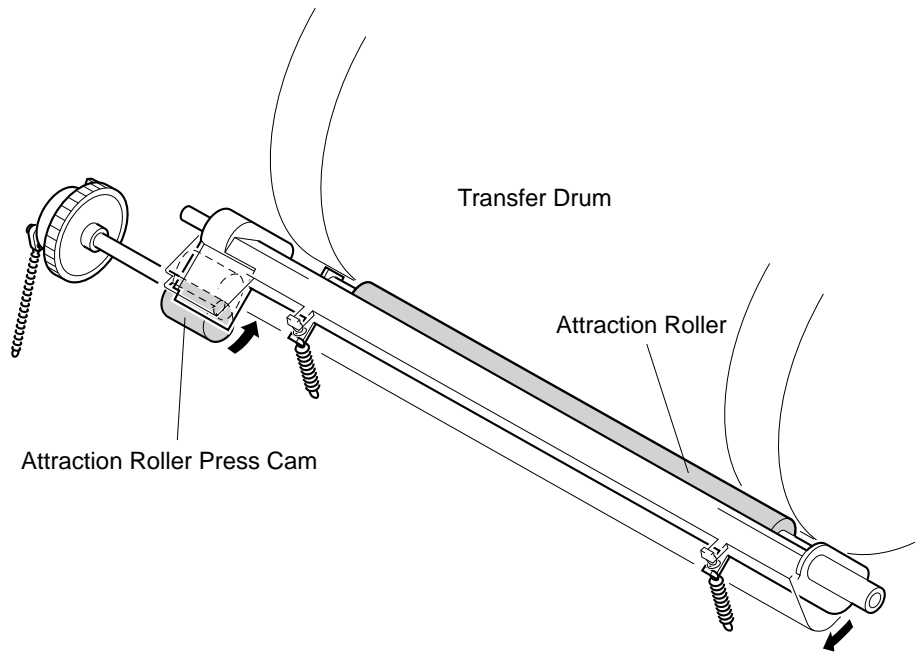
The gripper drive cam projection separates from the drive arm in accordance with the rotation of the transfer drum, closing the gripper. Moreover, since the cam is separated from the gripper arm while the GRIPON signal is “L,” the gripper does not open.



Attraction  
Roller

The attraction roller is normally separated from the transfer drum, and it is pressed against it as necessary.

After the gripper solenoid (SL4) is turned on and the paper top is clamped by the gripper, the attraction roller press solenoid (SL6) is turned on. The rotation of the main motor actuates the attraction roller press cam to press the attraction roller against the transfer drum. The attraction of the paper is detected by the attraction sensor (PS6).

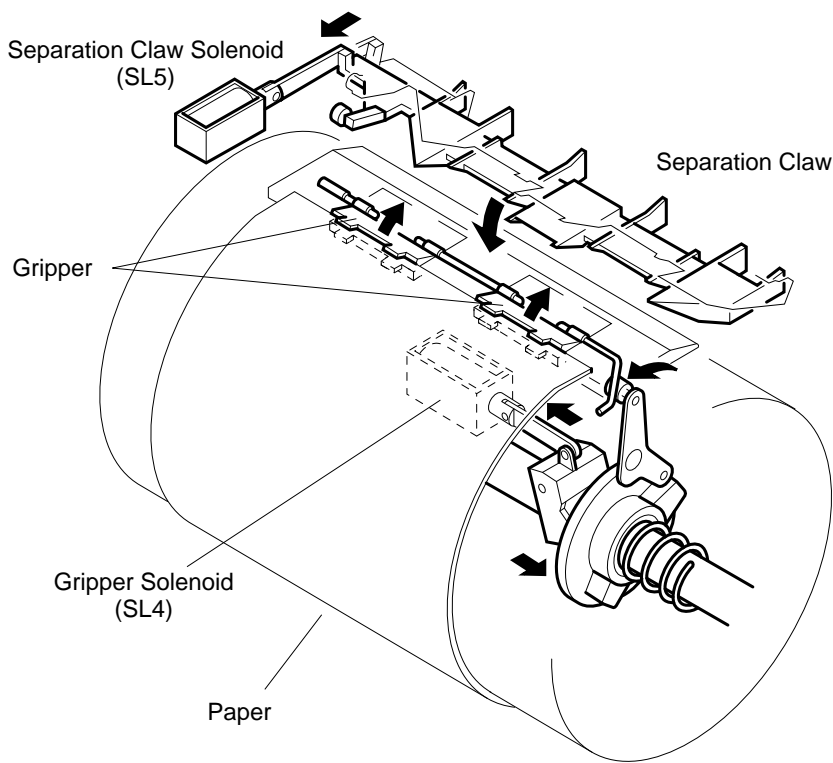


The attraction roller is not driven by any motor, but rotates along with the transfer drum. When the paper reaches the attraction roller, the attraction voltage corresponding to one cycle of the transfer drum is applied to the attraction roller. Thus, the paper is electrostatically attracted by the transfer drum.

In the full-color mode, the attraction roller rotates for the first color only. When the paper for the first color passes through the attraction roller, SL6 is turned off to separate the attraction roller from the transfer drum.

Separation

Upon completion of the transfer, the gripper solenoid (SL4) is turned on and the gripper opens to raise the leading edge of the paper. The separation claw solenoid (SL5) is also turned on to actuate the separation claw, which then scoops up the leading edge of the paper to separate the paper from the transfer drum. The separation of the paper is detected by the separation sensor (PS7).

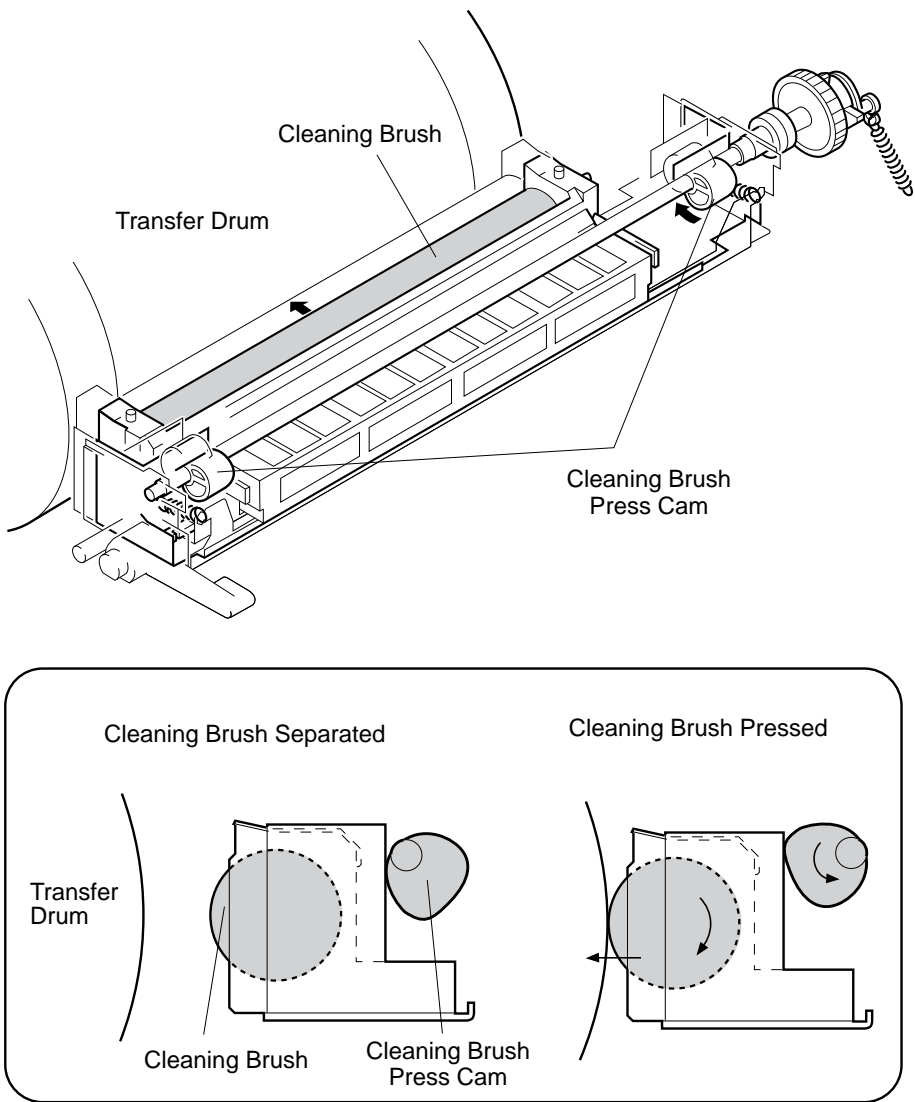


**Transfer Drum  
Cleaning  
Assembly**

The transfer drum cleaning assembly is operated following every 100 prints, upon power-on, door-open/close or cleaning of the density detection pattern after image quality stability control.

The transfer drum cleaner is normally separated from the transfer drum. After the transfer is completed and the paper is separated, the transfer drum cleaner press solenoid (SL8) is turned on to actuate the transfer drum cleaner press cam to press the cleaning brush against the transfer drum. When the cleaning brush motor (M5) is turned on, the cleaning brush starts rotating. After this cleaning is completed, SL8 is turned off to release the cam, and the spring force separates the cleaning brush from the transfer drum. Simultaneously, the cleaning brush motor is turned off.

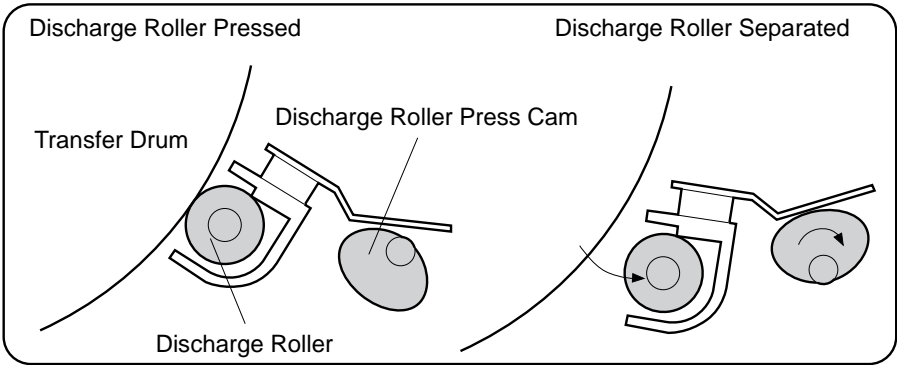
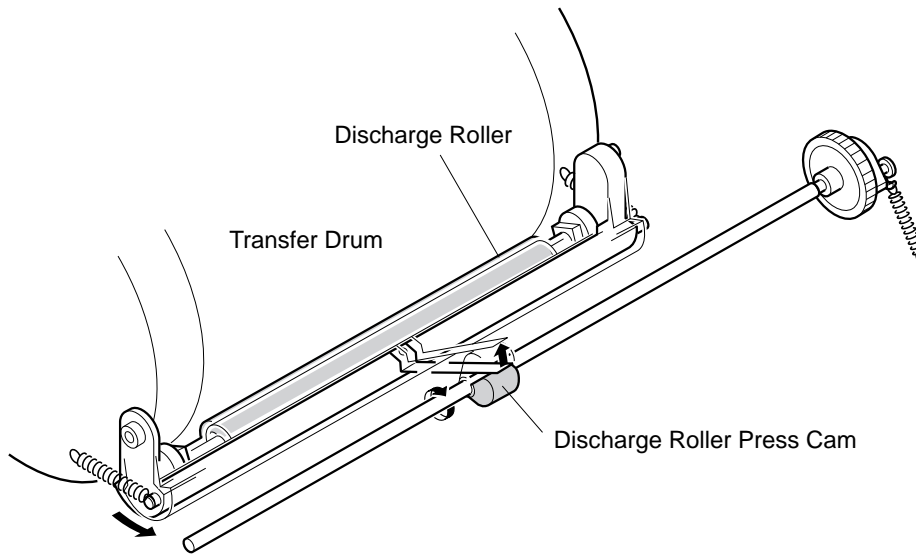
Cleaning brush rotation will not interrupt a multiple-page print job.



**Discharge  
Roller**

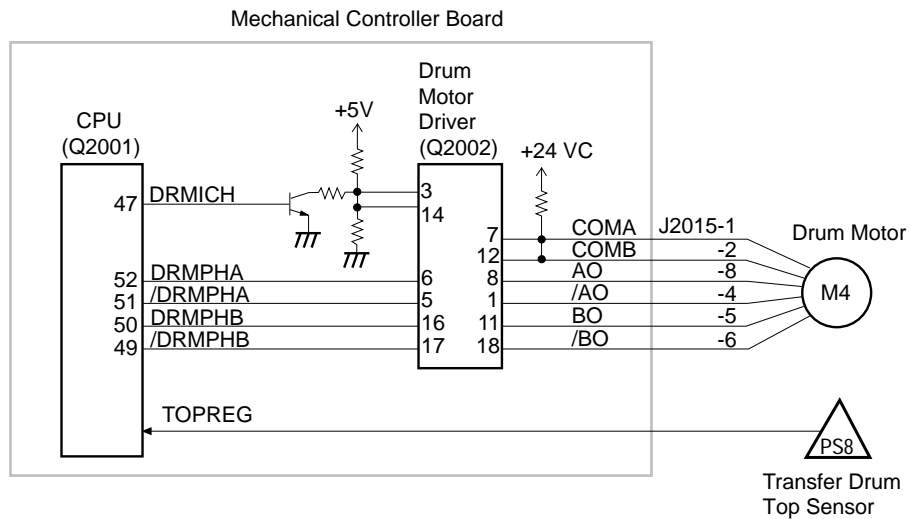
The discharge roller is normally pushed up by the discharge roller press cam so that it is separated from the transfer roller. After the paper is separated from the transfer drum, the discharge roller press solenoid (SL9) is turned on to release the cam and thus press the discharge roller against the transfer drum. After the discharge, SL9 is turned off to actuate the cam to push the discharge roller up, and then separate it from the transfer drum.

The discharge roller is not driven by any motor, but rotates along with the transfer drum. The discharge voltage corresponding to one cycle of the transfer drum is applied to the discharge roller to neutralize the electric charge remaining on the transfer drum surface.



## Drum Motor Drive Circuit

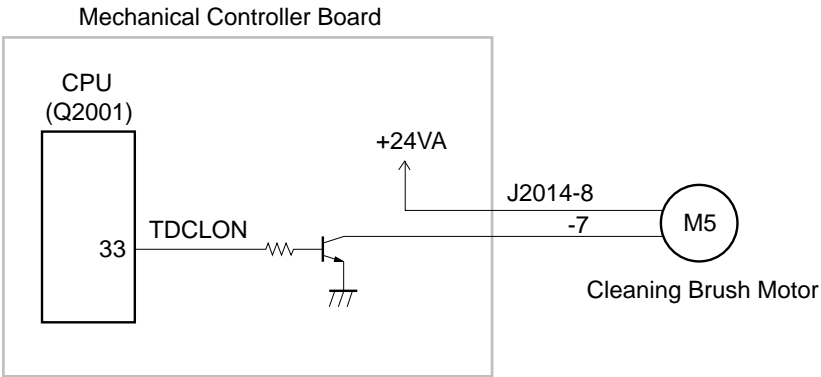
The drum motor is a two-phase stepping motor controlled by the drum motor driver (Q2002) on the mechanical controller. It drives the photo-sensitive drum and the transfer drum.



Upon receiving the print sequence command, the CPU (Q2001) in the mechanical controller sends the drum motor control signals (DRMPHA, /DRMPHA, DRMPHB, and /DRMPHB) and the drum motor rotation rate select signal (DRMICH) to the drum motor driver (Q2002) 0.2 second after the main motor starts. The Q2002 sends the drive signal to the drum motor based on these signals. 24 VC power supply is used to drive the drum motor. In order to slow down the paper feed speed through the fuser assembly in the transparency mode, the CPU sets the DRMICH signal to “H” to drive the drum motor at a low speed. If the transfer drum top sensor signal (TOPREG) remains unchanged for six seconds or more (12 seconds in the transparency mode), the CPU recognizes it as a drum motor error.

Cleaning  
Brush Motor  
Drive Circuit

The cleaning brush motor is a DC brushless motor. Controlled by the CPU on the mechanical controller, it is used to drive the cleaning brush.



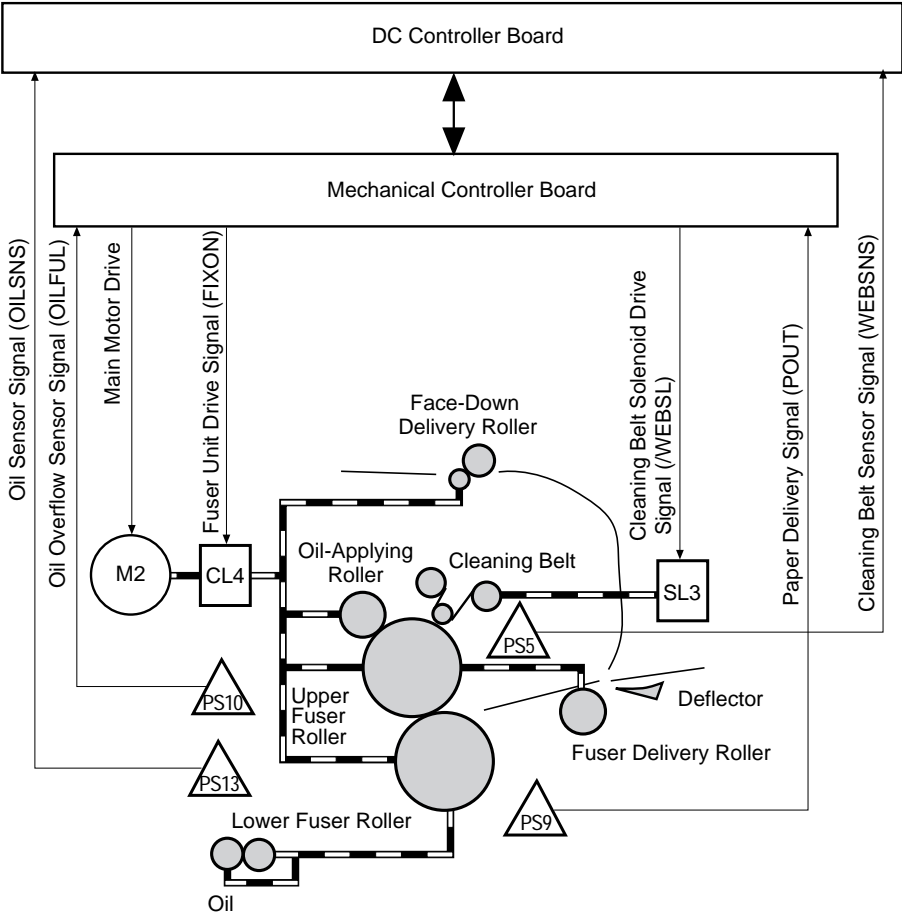
Upon power-on, door-open/close, or cleaning of the density detection pattern after image quality stability control, or after the paper is separated following every 100 prints, the CPU sets the cleaning brush motor drive signal (TDCLON) to “L” to drive the cleaning brush.



Fuser Assembly

**Outline**

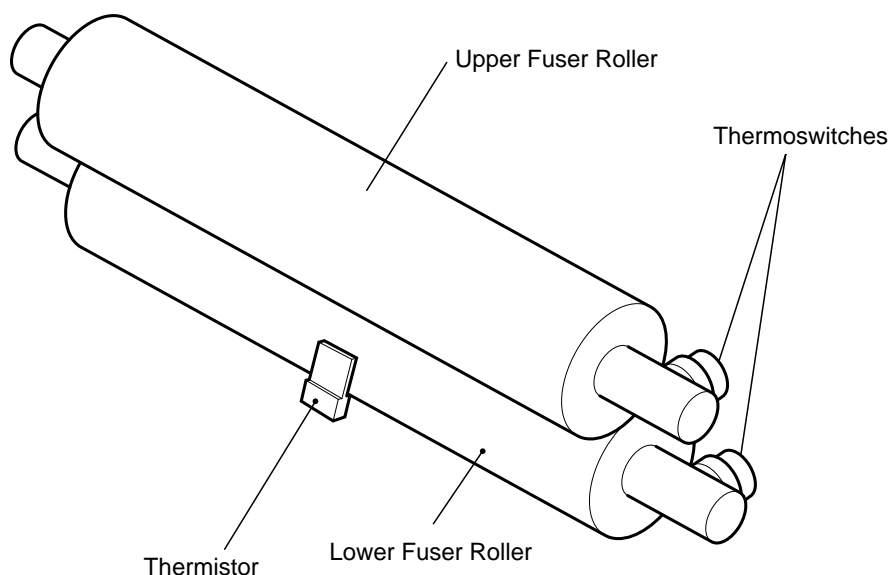
The paper separated from the transfer drum is fed into the fuser assembly and then delivered from it after passing through the upper and lower fuser rollers and the fuser assembly delivery roller. This delivery from the fuser assembly is detected by the delivery paper sensor (PS9). For the face-up tray, the paper is delivered without passing over any additional roller, while for the face-down tray, it is delivered after passing over the face-down delivery roller. The deflector that selects the face-up delivery or the face-down delivery is automatically switched by opening or closing the face-up tray. The deflector that selects the face-up delivery or the face-down delivery is automatically switched by opening or closing the face-up tray.



The upper and lower fuser rollers, the fuser assembly delivery roller, the oil applying roller, the face-down delivery roller, and the oil pump are driven by the main motor (M2). The cleaning belt is driven by the cleaning belt drive solenoid (SL3).

When the registration position for the fourth color in the full-color mode or the first registration position in the monochrome mode is detected on the transfer drum, the mechanical controller turns on the fuser assembly drive clutch (CL4). This transmits the rotation of the main motor to the upper and lower fuser rollers, the fuser delivery roller, the oil applying roller, and the oil pump.

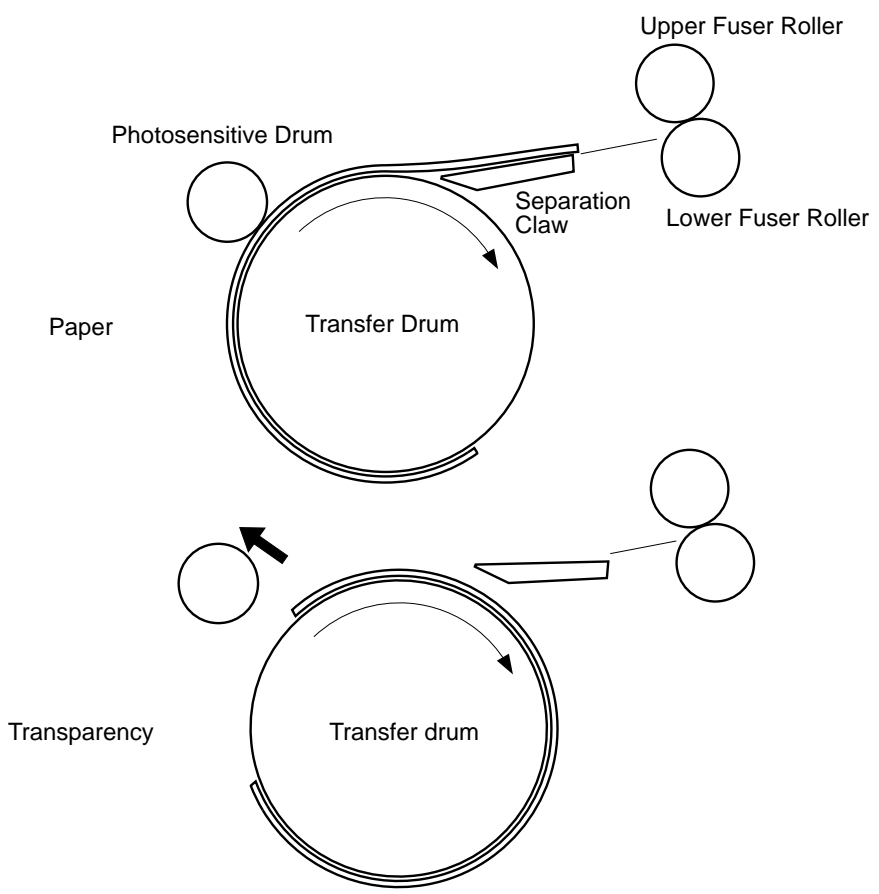
The upper and lower fuser rollers each have one built-in fuser heater (H1: 485W/100-120V; 430W/220-240V) that heats the roller. The fuser temperature is detected by the thermistor (TH) at the center of the lower roller surface. The thermostats are in contact with the respective shafts of the upper and lower fuser rollers.



Transparency  
Mode

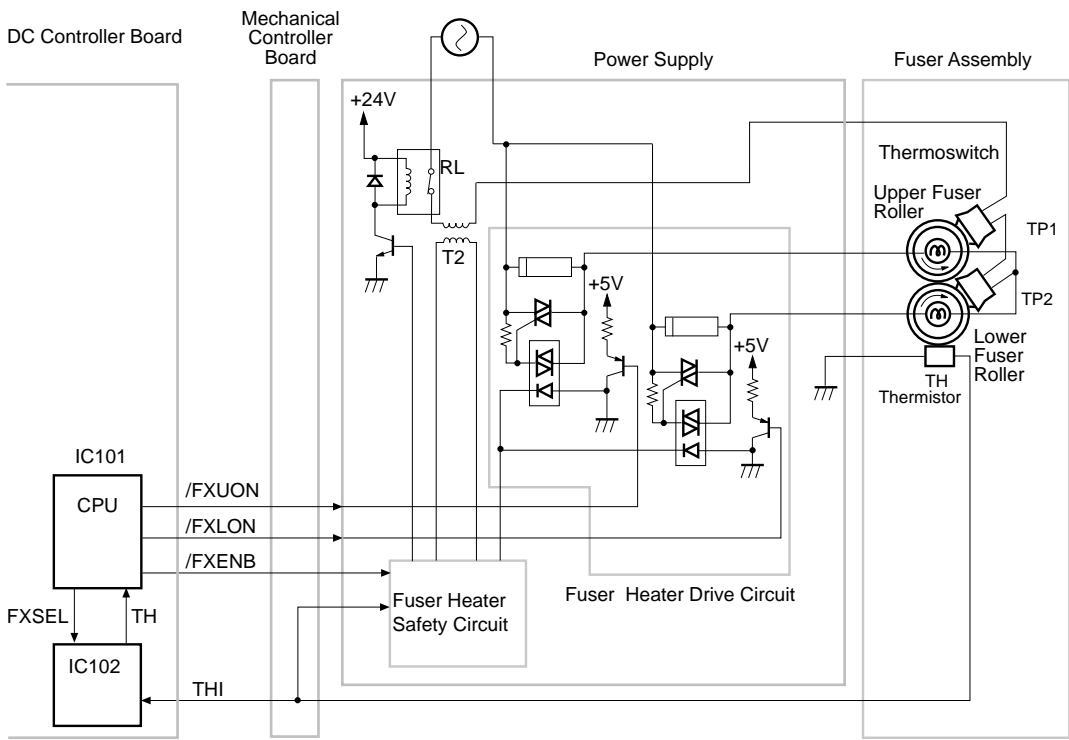
The fusing characteristics of overhead transparencies are poorer than that of normal paper. To improve the fusibility, the feed speed for a transparency is slowed down to half that of normal paper while the transparency is passing through the fuser assembly.

The distance between the transfer drum and the fuser assembly is short. So the trailing edge of the transparency would still be on the transfer drum when the leading edge has reached the fuser assembly. If the rotational speed of the fuser roller were slowed down to half its normal speed without changing the speed of the transfer drum, the feed speed would differ between the leading and trailing edges of the transparency. Therefore, the transparency is not separated immediately after the transfer is completed, but kept on the transfer drum for one additional rotation. After the transfer is completed up to the trailing edge of the transparency, the rotational speed of the transfer drum is slowed down to half its normal speed. At this time, the photosensitive drum is separated from the transfer drum so that the toner image on the transparency will not be disturbed. Subsequently, the transparency leaves the transfer drum and proceeds to the fuser assembly.



Fuser  
Temperature  
Control

The fuser temperature is detected by the thermistor (TH) on the lower fuser roller surface. As the surface temperature of the lower fuser roller rises, the resistance value of TH lowers and the voltage of the fuser temperature detect signal (THI) sent to the IC102 in the DC controller and the safety circuit in the power supply unit decreases.

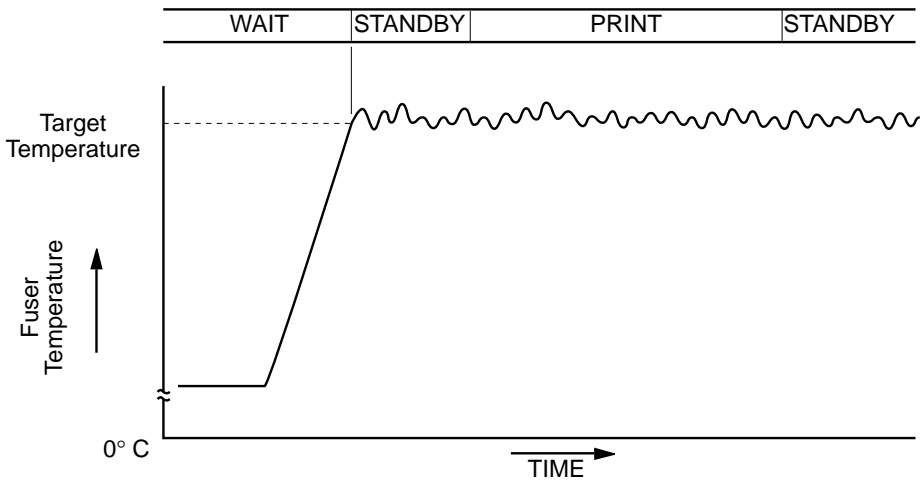


When the DC controller outputs the fuser temperature control enable signal ( $/FXENB$ ) to the fuser heater safety circuit, it controls the fuser temperature. The microcomputer (CPU) on the DC controller controls the fuser heater drive signals ( $/FXUON$  and  $/FXLON$ ) so as to maintain the fuser temperature at the specified value based on the voltage of the  $THI$  signal.

The printer starts to raise the fuser temperature while it is in the wait period, and when the temperature reaches the target value the printer enters the standby state.

**Note:** If the fuser temperature reaches the target value while image quality stability control and toner cartridge detection are still in progress, the printer will not enter the standby state.

If the fuser temperature is 100°C or lower when it starts to rise, the target temperature is set to a value higher than the normal one. After a certain period of time, the value is returned to the normal target temperature.



**Fuser  
Assembly  
Errors**

In order to prevent the fuser heater from malfunctioning, the printer provides the following three error detection functions. Full description of these functions are on the following pages.

**Error Type A**

The CPU monitors the voltage of the fuser temperature detect signal (THI). If it detects any abnormal value, it will notify the I/O controller as a fuser heater error and then shut off the power supplied to the heater.

**Error Type B**

If the fuser temperature rises abnormally and the temperature detected by the thermistor exceeds 217°C, the safety circuit will shut off the power supplied to the fuser heater irrespective of the output from the CPU. Simultaneously, the CPU recognizes it as a power supply error and notifies the I/O controller.

**Error Type C**

If the fuser temperature abnormally increases and the temperature of the thermoswitch exceeds about 230°C, the thermoswitch will be turned off to shut off the power supplied to the fuser heater.

**Fuser Error A:  
DC Controller  
Detects a  
Fuser Heater  
Error**

If the fuser assembly is abnormally heated or if the fuser assembly does not reach the specified temperature for some reason, the DC controller will store a fuser heater error and then shut off the power supplied to the heater.

The DC controller notifies the I/O controller of this fuser heater error. The DC controller measures the time elapsed after the power is shut off (see note 2 on the next page). If a fuser heater error occurs and then the power is turned on within 30 minutes of having been turned off, the DC controller will determine that the temperature of the fuser heater is not low enough and keep the fuser heater off.

The DC controller recognizes any of the following situations as a fuser heater error:

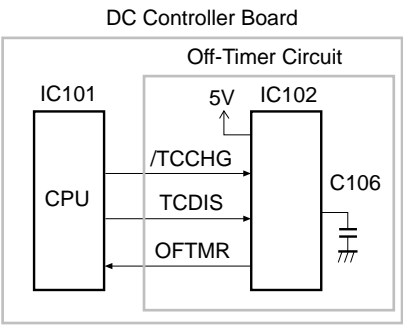
- When the power is turned on, a fuser assembly error is found stored in the DC controller.
- Sixty seconds after the power is turned on, the value of the fuser temperature detect signal (THI) sent to the CPU on the DC controller has not changed.
- After the fuser heater is turned on, any of the following phenomena occur:
  - The temperature of the fuser heater does not reach 40°C within 130 seconds.
  - The temperature of the fuser heater does not reach 60°C within 80 seconds of reaching 40°C.
  - The temperature of the fuser heater does not reach 80°C within 80 seconds of reaching 60°C.
  - The temperature of the fuser heater does not reach 100°C within 80 seconds of reaching 80°C.
  - The temperature of the fuser heater does not reach 120°C within 80 seconds of reaching 100°C.
  - The temperature of the fuser heater does not reach the target value within 160 seconds of reaching 120°C.
- The temperature of the fuser heater falls below 120°C after it has already reached the target value.
- The temperature of the fuser heater exceeds 200°C during the standby or print period (the fuser heater malfunctions).

- When the THI signals are compared after changing the sensitivity of the thermistor (see note 3 below) from the high range to the low range, there is almost no difference recognized (the wiring for the thermistor is broken).

**Notes:**

- 1 If a failure occurs in the fuser heater, do not turn on the printer power switch for about 30 minutes. Even if the power switch is turned on during this time period, the CPU determines the fuser heater failure has occurred and the fuser heater will not be turned on to prevent it from overheating. Discharging jumper JP102 on the DC controller board will reset this circuit.
- 2 The off-timer circuit on the DC controller board can measure the lapse of time after the power is turned off. The measured time is used for release of fuser assembly errors and for temperature/humidity sensing.

While the power is turned on, the CPU (IC101) sets the off-timer charge signal (/TCCHG) to be output to IC102 to “L” to charge C106. After the power is turned off, C106 begins to discharge.



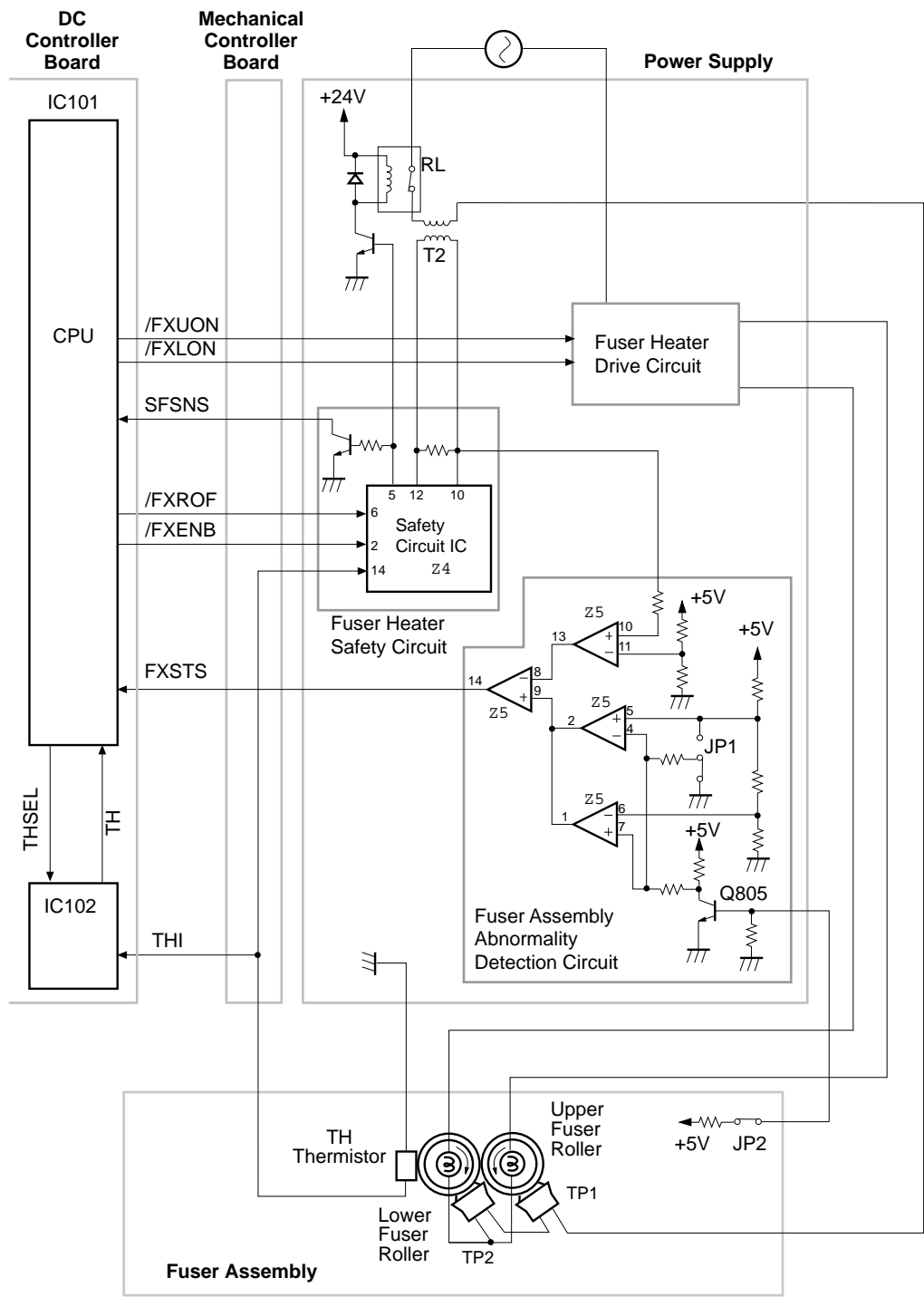
When the power is turned on again, the CPU detects the voltage of C106 with the off-timer sense signal (OFTMR), sets the TCCHG signal to “L,” and charges C106 to the specified voltage. Then the off-timer discharge signal (TCDIS) is set to “H” and C106 is forcibly discharged to the voltage level measured at the time of power-on, and the required time is measured. Based on this measured time, the time during which the power was turned off is calculated.

- 3 The sensitivity of the thermistor differs between its high and low temperature ranges. In order to increase the detection accuracy in either range, the CPU in the DC controller uses the thermistor sensitivity select signal (THSEL) to switch the thermistor sensitivity between the mode in which the detection accuracy is higher at low temperatures and that in which it is higher at high temperatures. When the THSEL signal goes “H,” the thermistor is put in the low temperature detection mode, and when “L,” in the high temperature detection mode.



**Fuser Error B: Fuser Safety Circuit Detects Error**

The fuser heater safety circuit in the power supply unit will shut off the power supplied to the fuser heater if the fuser temperature rises abnormally.



The safety circuit IC (Z4) in the power supply unit monitors the fuser temperature detect signal (THI) sent to pin 14. If the voltage output from the thermistor becomes about 1.6 V with an increase in the fuser temperature, the safety circuit IC will set the output of pin 5 to “L” and turn off the relay (RL) to shut off the power supplied to the fuser heater.

Simultaneously, the safety circuit sensing signal (SFSNS) sent to the CPU on the DC controller goes “H.” With this setting, the CPU determines that a failure has occurred in the fuser assembly and notifies the I/O controller of a power supply failure.

To reset the fuser safety circuit, turn off the printer for about 30 minutes or discharge jumper JP102 on the DC controller board.

**Fuser Error C:  
Abnormality  
Detection  
Circuit Error**

Located in the power supply unit, the fuser abnormality detection circuit monitors the fuser assembly for voltage compatibility and fuser heater continuity:

- **Voltage compatibility.** The fuser assembly abnormality detection circuit checks that the rated voltage of the power supply unit matches that of the fuser assembly. For example, if the fuser assembly for 220 V is connected to the power supply for the 10 V version, the circuit will recognize it as a mismatch in rated voltage due to incorrect installation of the fuser assembly. In this case, the CPU on the DC controller notifies the I/O controller of a power supply failure and stops the printer.

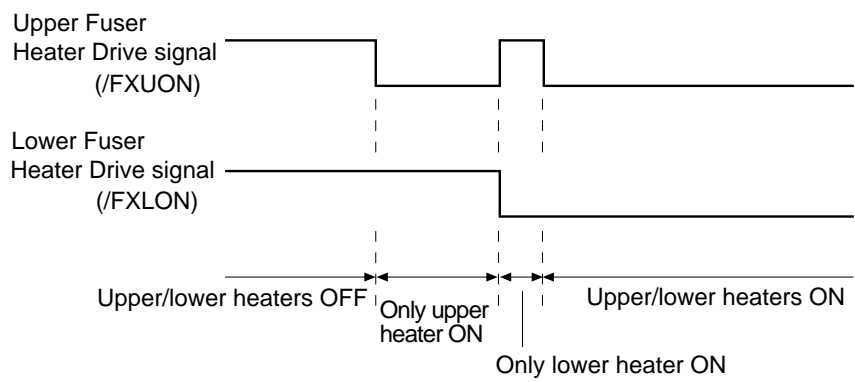
The rated voltage of the power supply unit is set with the jumper (JP1) and monitored at pin 4 on Z5. The specified voltage of the fuser assembly is set with the jumper (JP2) within the fuser assembly and monitored at pin 7 on Z5. Pin 2 on Z5 goes “L” when the rated voltage of the power supply unit matches that of the fuser assembly; it goes “H” when it does not. If there is a mismatch, the fuser assembly abnormality detect signal (FXSTS) output from pin 14 on Z5 goes “H,” and the CPU detects the incorrect installation of the fuser assembly as a result.

- **Fuser heater continuity:** The fuser assembly abnormality detection circuit detects the AC current flowing in the fuser heater. If no AC current flows, the CPU on the DC controller will determine that the fuser heater wires are broken, notify the I/O controller of a fuser assembly failure, and then shut off the power.

An abnormality in the AC current sent to the fuser heater is detected by the voltage generated by T2. The voltage value generated by T2 is monitored at pin 10 on Z5. If the fuser heater is broken and no AC current flows, Z5-13 will become “H” and the fuser assembly abnormality detect signal (FXSTS) output at pin 14 on Z5 goes “L.” When the AC current flows normally, the FXSTS signal alternates between “H” and “L” at a certain frequency. Thus, the CPU can detect that the fuser heater is broken by the FXSTS signal.

Notes:

- 1 When starting the temperature control, the printer individually turns on the upper and lower fuser heaters and monitors them for breakage with the FXSTS signal.



- 2 To reset the fuser assembly abnormality detection circuit, turn off the printer for about 30 minutes or discharge jumper JP102 on the DC controller board.

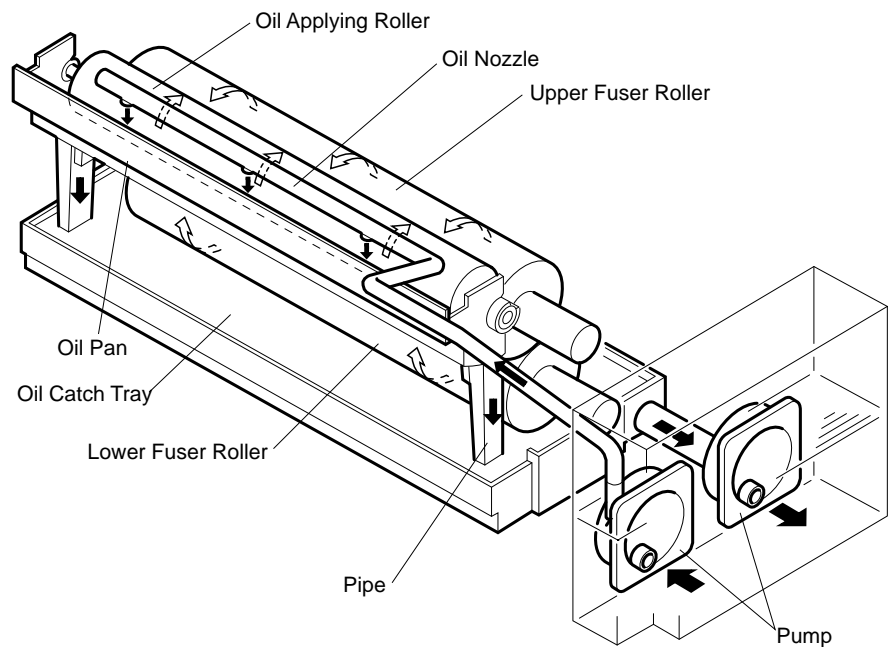
Oil  
Circulation  
System

In order to prevent the tracking of toner onto the fuser rollers, the printer uses an oil circulation system to lubricate the rollers.

**Note:** Laser printer engines typically have fuser lubrication, but usually in the form of oil-impregnated rollers. Due to the high fusing temperature and the characteristics of the mono-component toner used in this printer, additional lubrication is required.

An oil applying roller remains in contact with the upper fuser roller. When the fuser assembly drive clutch (CL4) is engaged, the main motor drives the upper and lower fuser rollers, the oil applying roller, and the oil pump.

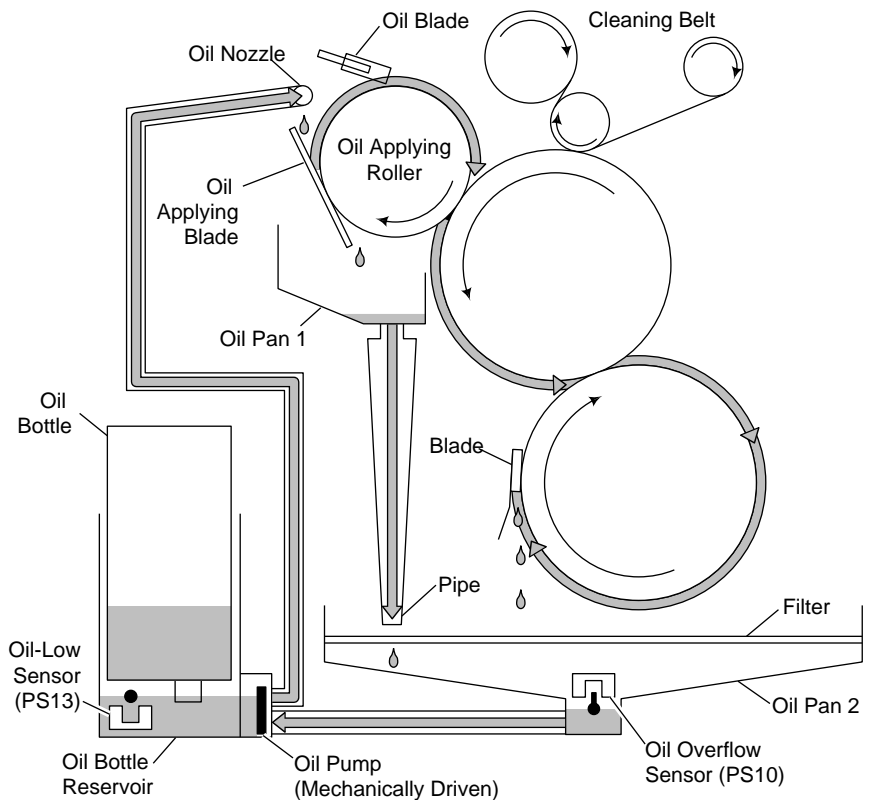
The oil sent from the oil bottle to the oil pan under the oil bottle case is collected using the pump and then dropped from the oil nozzle down to the oil applying roller. Very small amounts of oil remain on the oil applying roller and the oil applying blade. As the applying roller rotates, the oil blade controls the amount of oil and then the oil is applied to the upper fuser roller. Any excessive oil drops from both ends of the applying blade down to the oil tank and then drops down to the oil catch tray after passing through a pipe. The oil catch tray has a filter that filters out dust and other foreign matter. The filtered oil is sucked by the pump into the oil bottle for recirculation.



The amount of oil remaining in the fuser oil bottle is detected by the oil-low sensor (PS13) mounted to the chassis behind the fuser assembly. As the oil level drops, a floating ball in the fuser oil bottle interrupts PS13 and the oil sensor signal (OILSNS) goes “H.”

If the CPU on the DC controller detects that oil is low, it issues an oil-low notice to the I/O controller. Approximately 50 sheets of paper can be printed before the CPU determines that oil has run out and stops the printer.

The oil catch tray is equipped with an oil overflow sensor (PS10). A floating ball with a flag is floated in the oil catch tray, and as the oil level rises, the flag interrupts the sensor and the oil overflow sensor signal (OILFUL) sent to the mechanical controller goes “H.” When the DC controller is notified of the overflow of oil by the mechanical controller, it stops the printer and issues the oil-overflow signal to the I/O controller. If the OILFUL signal continues to be “H” for 2 seconds or more, the DC controller notifies the I/O controller that an oil overflow failure has occurred.



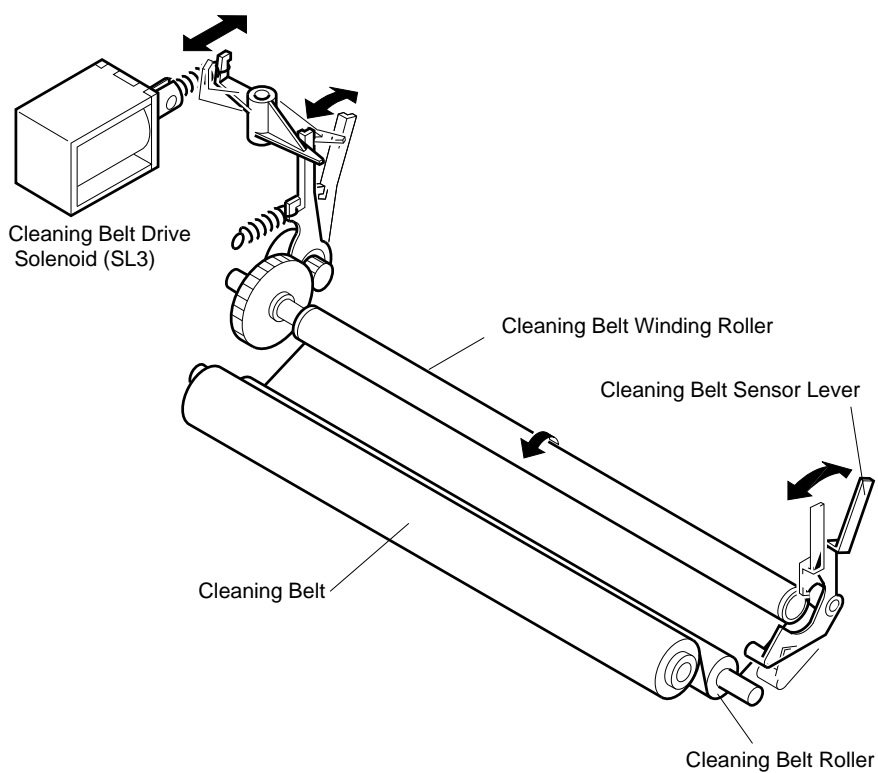
**Note:** Only the floating ball actuator portion of oil-low sensor PS13 is within the fuser assembly. The sensor portion is in the oil sensor assembly, which is mounted on the chassis behind the fuser.

Fuser Cleaner  
Assembly

The printer uses a cleaning assembly to clean the upper fuser roller.

This assembly comprises a cleaning belt winding roller, a cleaning belt roller, and a rolled cleaning belt. After every seven prints, the cleaning belt winding roller rotates and the contact surface of the cleaning belt moves to clean the upper fuser roller. In normal operation, the cleaning belt moves by one step each time the cleaning belt drive solenoid (SL3) is actuated. In the transparency mode it moves by two steps.

The cleaning belt has a notch about 12" (30 cm) from its trailing edge. When this notch is detected by the cleaning belt sensor (PS5), the cleaning belt sensor signal (WEBSNS) goes "H" and the DC controller notifies the I/O controller that the cleaning belt is near its end-of-life. The DC controller will notify the I/O controller and stop the printer after about 500 more prints. At that point, you must replace the fuser assembly.



Main Motor Drive Circuit

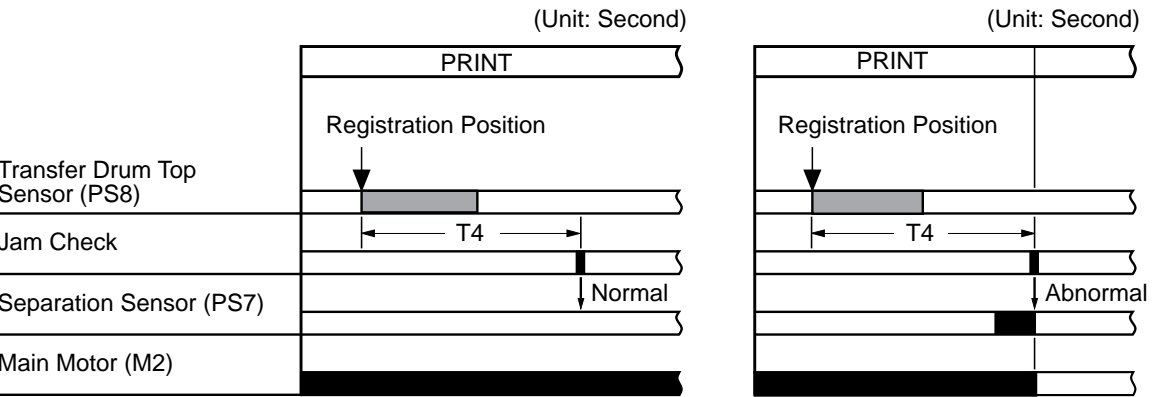
**Outline**      The main motor is a DC brushless motor controlled by the CPU on the mechanical controller and used to drive the loads peripheral to the transfer drum and the fuser/delivery unit. Those loads include

- Fuser Assembly:
  - Upper and lower fuser rollers
  - Face-down delivery roller
  - Fuser delivery roller
  - Oil-applying roller
  - Oil pump
- Transfer Drum Peripherals
  - Attraction roller press cam
  - Transfer drum press cam
  - Cleaning brush press cam
  - Discharge roller press cam
- Waste toner screw inside the photoconductor cartridge

**Description of Operation**      When the print sequence command is received, the CPU (Q2001) in the mechanical controller sets the main motor drive signal to “L” to drive the main motor.

The mechanical controller monitors the main motor ready signal (/MRDY) to check whether the main motor is rotating at the specified speed. If the main motor operates at any speed other than the specified value, the /MRDY signal becomes “L.” If the /MRDY signal goes “L” for two seconds or more continuously, the CPU will determine that a main motor failure has occurred.

In the transparency mode, the CPU sets the main motor rotation rate select signal (MLOW) to “H” to slow down the rotational speed to half that normal and thus improve the fusibility.



T4=3.4 (5.3 in case of overhead transparencies)



## Paper Jam Detection

### Outline

The following paper sensors are provided to detect whether paper is present and whether the paper is fed normally:

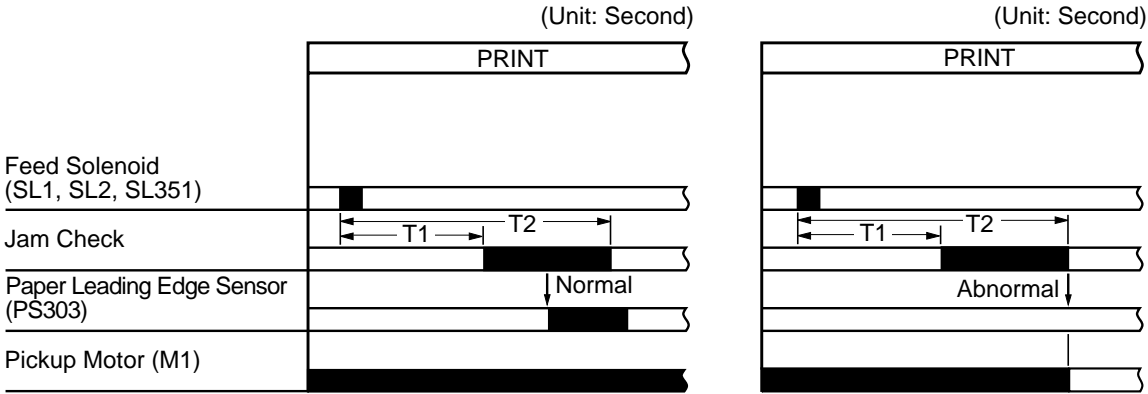
- PS301: Cassette paper-present sensor, located on the cassette pickup assembly board.
- PS302: Paper registration sensor, located on the cassette pickup assembly board.
- PS303: Paper leading-edge sensor, located on the cassette pickup assembly board.
- PS8: Transfer drum top sensor, located within the transfer drum assembly.
- PS6: Attraction sensor, located within the transfer drum assembly.
- PS7: Separation sensor, located within the transfer drum assembly.
- PS9: Delivery paper sensor, located with the fuser assembly.

The CPU in the mechanical controller monitors sensor timing and compares it against what has been calculated to be normal. Abnormal sensor timing is reported to the DC controller, which stops printer operation. The DC controller then notifies the I/O controller of the jam condition.

There are 11 jam conditions, as described on the following pages.

Pickup Delay Jam

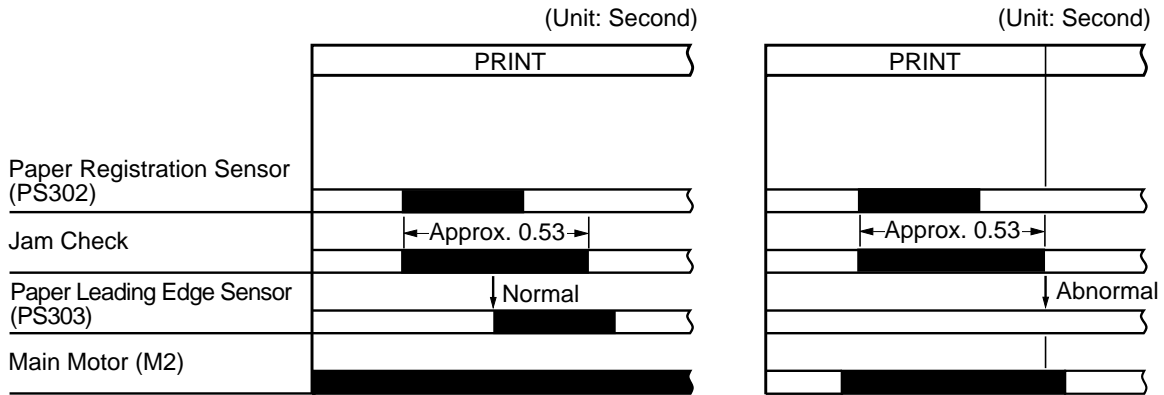
The CPU determines that a pickup delay jam has occurred if the paper does not reach the registration paper sensor (PS302) within a specified period of time after the feed solenoid is engaged.



T1=0.83 (Cassette feed, Manual feed), 1.17 (Paper feeder)  
T2=2.57 (Cassette feed, Paper feeder), 2.07 (Manual feed)

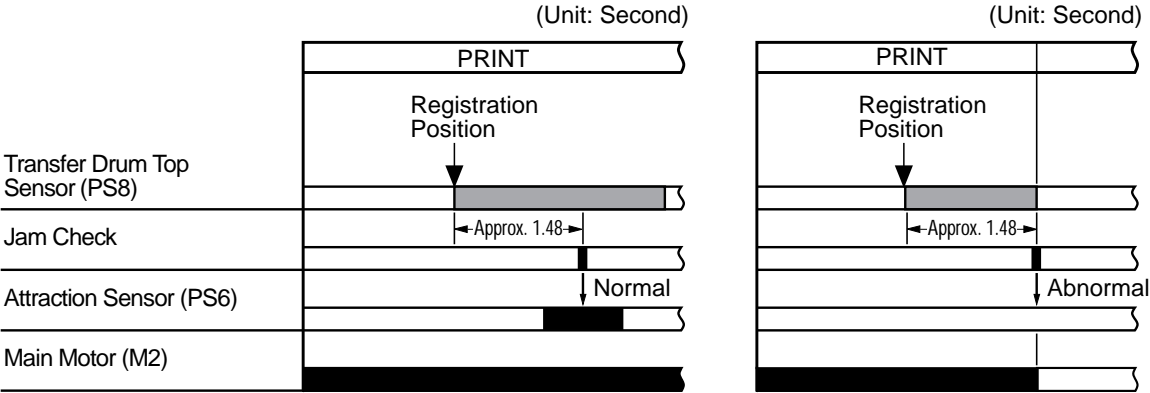
# Paper Top Position Delay Jam

The CPU determines that a paper top position delay jam has occurred if the paper does not reach the paper leading-edge sensor (PS303) within a specified period of time after the registration paper sensor (PS302) detects the leading edge of the paper.



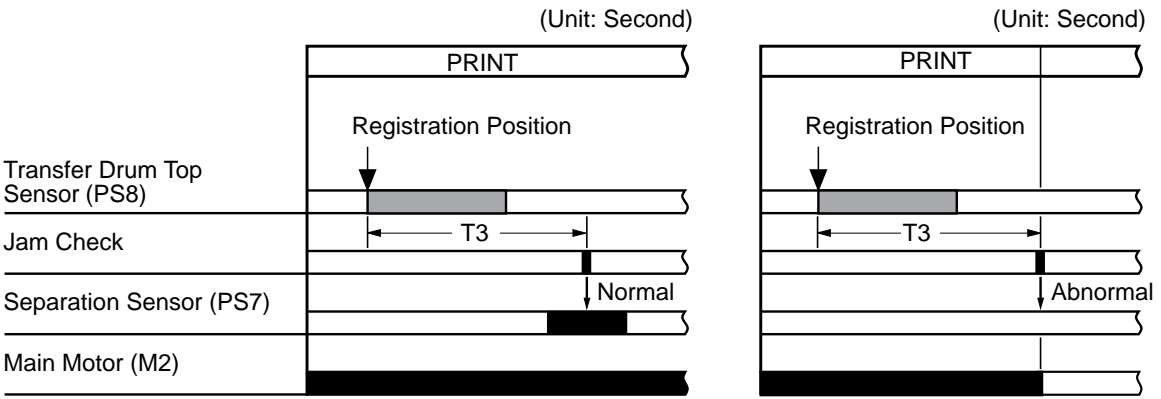
Grip Jam

The CPU determines that a grip jam has occurred if the attraction sensor (PS6) does not detect the paper a specified period of time after transfer drum registration position detection (in the full-color mode, the registration position for the fourth color is detected).



Separation  
Delay Jam

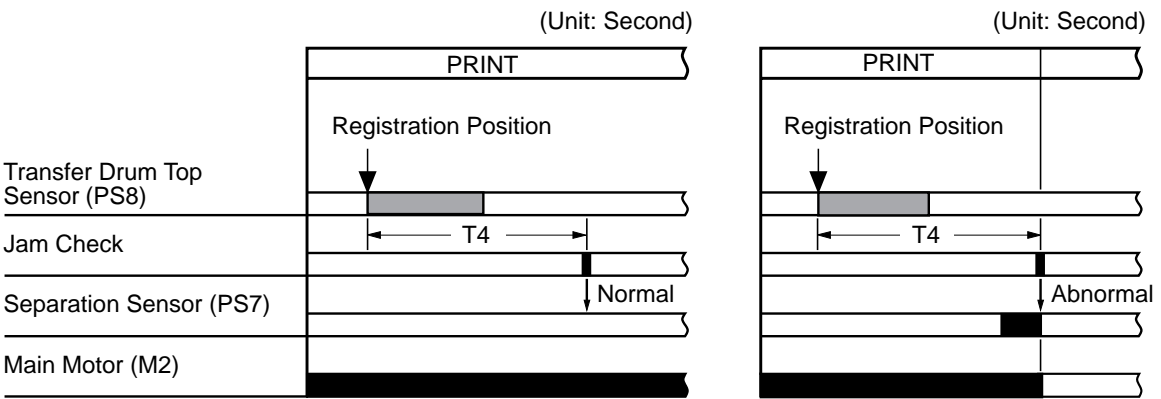
The CPU determines that a separation delay jam has occurred if the paper does not reach the separation sensor (PS7) a specified period of time after transfer drum registration position detection (in the full-color mode, the registration position for the fourth color is detected).



T3=4.17 (6.88 in case of overhead transparencies)

Separation  
Stationary Jam

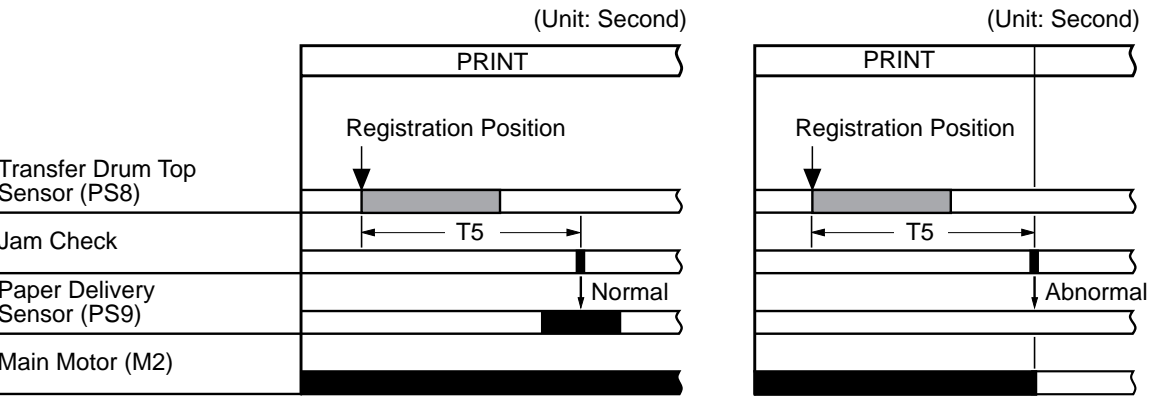
The CPU determines that a separation stationary jam has occurred if the paper is detected by the separation sensor (PS7) a specified period of time after transfer drum registration position detection (in the full-color mode, the registration position for the fourth color is detected).



T4=3.4 (5.3 in case of overhead transparencies)

**Delivery Delay Jam**

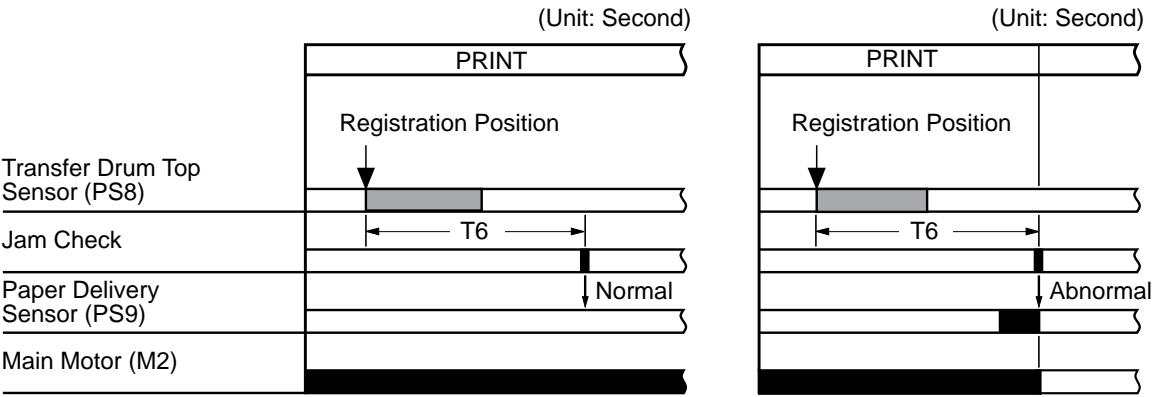
The CPU determines that a delivery delay jam has occurred if the paper does not reach the delivery paper sensor (PS9) a specified period of time after transfer drum registration position detection (in the full-color mode, the registration position for the fourth color is detected).



T5=5.23 (8.99 in case of overhead transparencies)

**Delivery**  
**Stationary Jam**

The CPU determines that a delivery stationary jam has occurred if the paper does not pass through the delivery paper sensor (PS9) a specified period of time after transfer drum registration position detection (in the full-color mode, the registration position for the fourth color is detected).

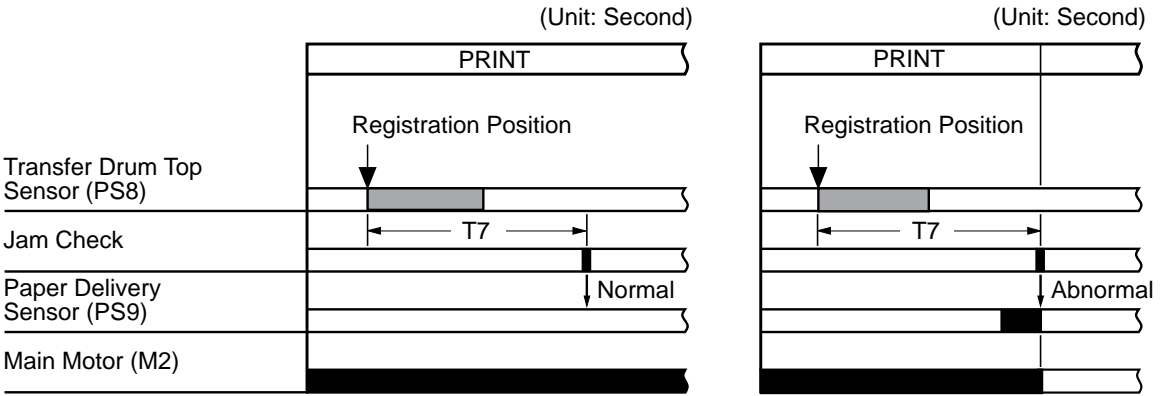


T6=8.91 (15.06 in case of overhead transparencies)



Multifed Paper  
Stationary Jam

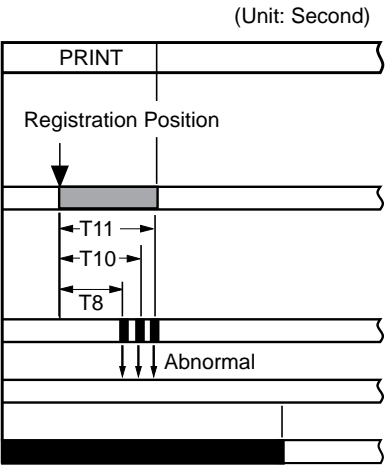
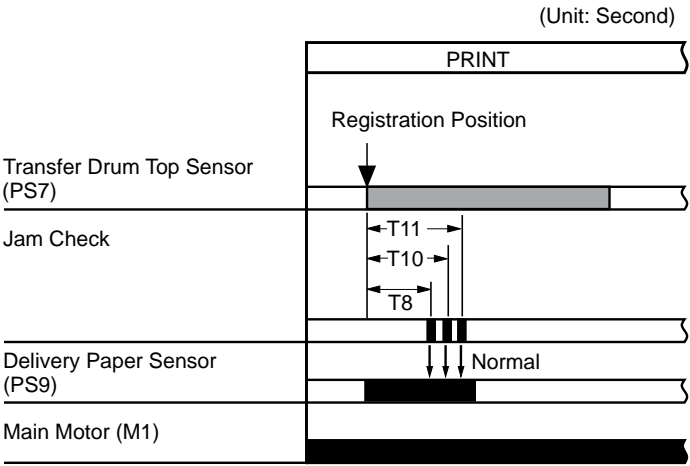
The CPU determines that a multifed paper stationary jam has occurred if the delivery paper sensor (PS9) detects paper a specified period of time after transfer drum registration position detection (in the full-color mode, the registration position for the fourth color is detected).



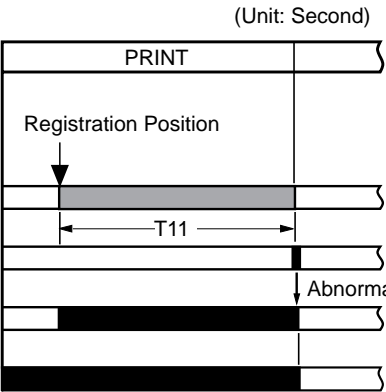
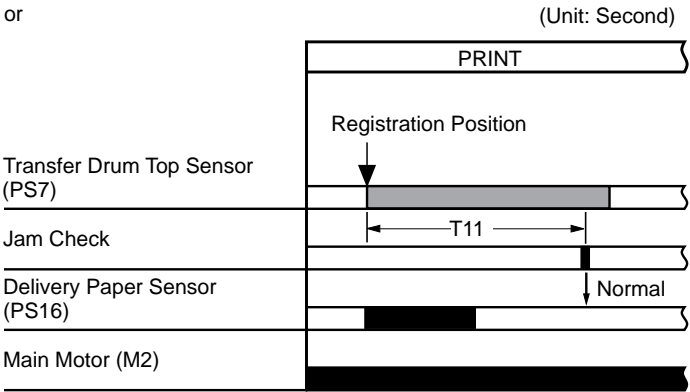
T7=0.5, 1.0, 2.0, 3.0

Nondedicated  
Transparency  
Jam

- The CPU determines that a nondedicated transparency jam has occurred if one of the following is sensed:
- The white band on the leading edge of the transparency is not detected by the paper leading-edge sensor (PS303) a specified period of time after it is detected at the transfer drum registration position.
  - The white band is detected after a specified time subsequent to that.



T8=1.49, T9=1.57, T10=1.64



T11=3.29

**Wrong Paper  
Length Feed  
Jam**

The CPU detects the paper size with the paper leading-edge sensor (PS303). It determines that a wrong paper size feed jam has occurred if it detects paper shorter than 9.05" (230 mm) or longer than 14.96" (380 mm).

**Initial Residual Jam**

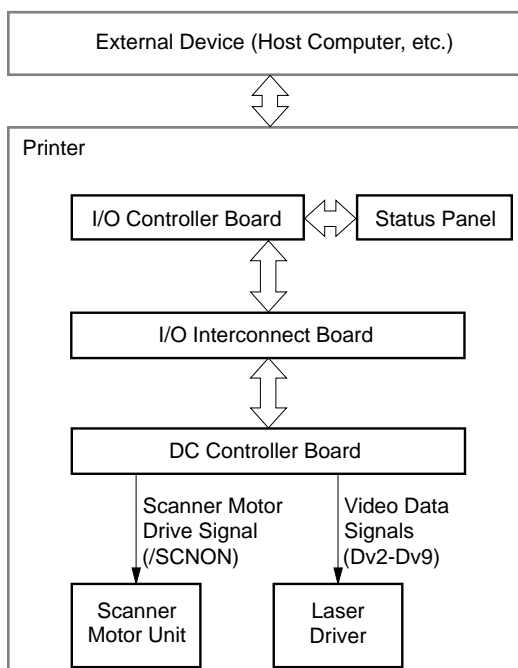
The CPU determines that an initial residual jam has occurred under the following two conditions:

- If any of the following sensors detects the paper a specified period of time (0.5 or 2.27 seconds) after the power switch is turned on
  - Registration paper sensor (PS302)
  - Paper leading-edge sensor (PS303)
  - Separation sensor (PS7)
  - Paper delivery sensor (PS9)
- After the power switch is turned on, and the transfer drum rotates, if the attraction sensor (PS6) detects paper a specified period of time (1.48 seconds) after transfer drum registration position detection.

## **VI. System Interface**

## Outline

The I/O controller in the printer converts the print data sent by external devices, including the host computer, into dot data, which is then output from the I/O controller to the DC controller. The types of interface signals transmitted between the I/O controller and the DC controller, as well as an outline of the operation of the printer using the interface signals, are described below.



**Note:** For more information on the I/O system interface, see the following documents that are bundled with Service Source.

- “Inside the Color LaserWriter”

This is a short 15-page document that graphically illustrates the highlights of the controller technology in this printer. Included is a description of Color PhotoGrade, Contone compression technology, and general principles of digital color imaging.

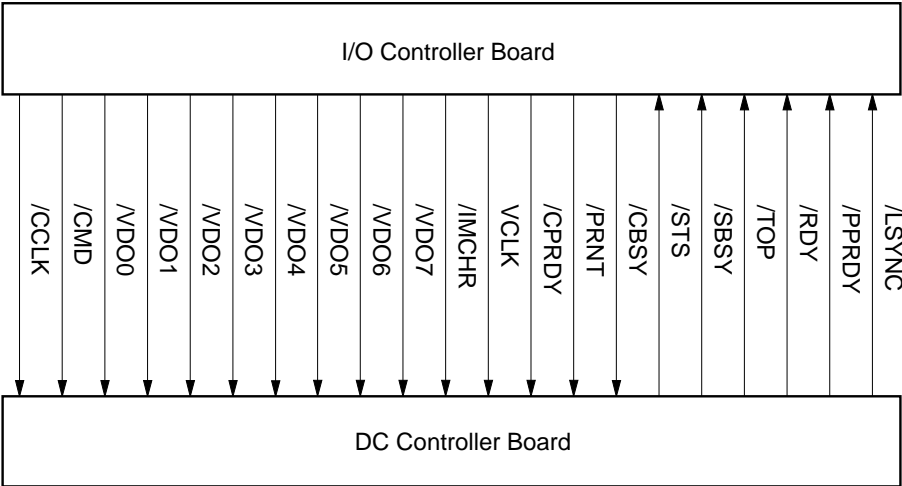
- “Developer Tech Notes”

This is a product of Apple Developer Technical Publications and contains all the information that developers receive. Chapter 1 discusses some of the broader issues of the printer, such as pinouts, connectors, extended memory, and the like.

Video Interface

I/O Interface  
Signals

The I/O interface signals are as illustrated below.



Description of  
Operation

When power is turned on, the printer enters the wait state.

At the end of the wait state, the DC controller sends the ready signal (/RDY) to the I/O controller to verify that the printer is ready to print.

When the /RDY signal goes “L” and the data for printing one page is available, the I/O controller sends the print signal (/PRNT) to the DC controller.

Upon receiving the /PRNT signal, the DC controller issues the print sequence command to the mechanical controller and starts the initial rotations (INTR) sequence.

At the end of the INTR sequence, the DC controller sends the vertical sync signal (/TOP) to the I/O controller within the specified time.

The I/O controller sends the video signals (/VDO7-0), which synchronize with the horizontal sync signal (/LSYNC) and the /TOP signal sent by the DC controller, to the DC controller. In full-color mode, the I/O controller sends the M (magenta), C (cyan), Y (yellow), and K (black) video signals to the DC controller in that order. In the monochrome mode, the I/O controller sends only the video signals for monochrome.

The DC controller generates 8-bit video data signals (DV2-DV9) in accordance with the video signals (VDO0-VDO7) sent by the I/O controller, and then sends them to the PWM-IC in the laser/scanner assembly. The laser drive circuit turns the laser diode on and off in accordance with the laser drive signal (internal signal in the laser/scanner assembly) output from the PWM-IC, to generate the modulated laser beam.

The laser beam emitted by the laser drive signal is scanned across the photosensitive drum to create a latent image on the drum.

The latent image on the photosensitive drum is transferred to plain paper. The paper is then delivered onto the face-down tray or the face-up tray.

While printing a page, the DC controller checks whether or not the /PRNT signal has been sent by the I/O controller.

If no /PRNT signal has been sent, the printer terminates the print sequence with the current page and initiates the last rotations. At the end of the last rotations, the printer enters the standby (STBY) state.

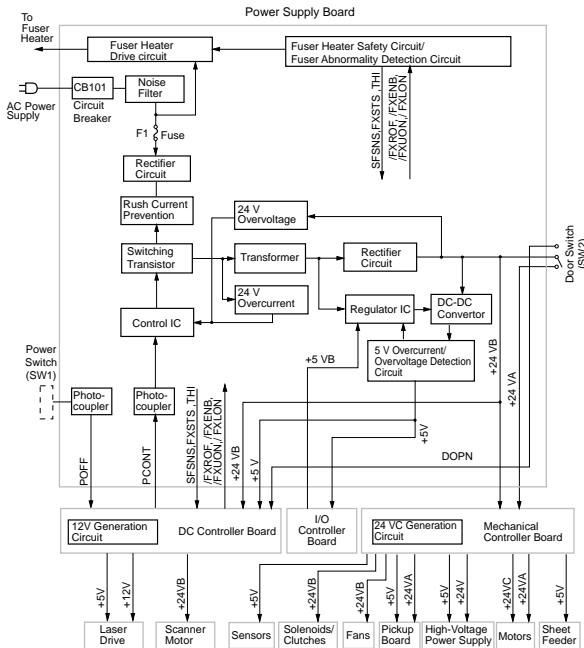
On the other hand, if the /PRNT signal has been sent, the printer continues the print sequence.



## **VII. Power Supply**

## Outline

The power switch uses a remote switch method. When the power switch (SW1) is turned on, the DC controller is informed of this by the power supply circuit. The DC controller turns on the control IC in the power supply circuit, and the AC power supply is sent to the power supply circuit via the circuit breaker, the noise filter, etc.



When the front door, the fuser access cover, and the pickup cover are closed, the door switch (SW2) is automatically turned on and the power supply is sent to the driving loads.

This circuit also supplies +24 VDC and +5 VDC, which are required for the printer itself. The +24 VDC is supplied for the motors, the exhaust fans, the clutches and other driving components, as well as for the cassette pickup board and the high-voltage power supply board. The 12V power is generated in the DC controller to drive the laser diode.

The +24 VDC consists of

- Normal +24 VA, which is shut off when SW2 is turned off by the opening of the front door, fuser access cover, or the pickup cover.
- Voltage of +24 VB, which is always on whether SW2 is turned on or off.
- Voltage of +24 VC, which is shut off in the power-saving mode (see below) or when the cover is opened, is generated in the mechanical controller board.

The 5 V power supplied to the I/O controller is monitored using the 5 VB signal to ensure it is always supplied.

The printer enters the energy-saving mode on command from the I/O controller. It returns to the normal mode when a command to cancel the power-saving mode is received from the I/O controller.

## Remote Switch

When the power switch on the printer is turned off, the power supply circuit sets the power off signal (POFF) sent to the DC controller to “H.” When the printer is subsequently ready to be turned off, the DC controller sets the power off control signal (PCONT) to “L.” This stops the switching regulator for the power supply circuit and turns off the printer.

This indirect shutdown of the printer allows the transfer drum to be parked in the home position and allows for excess heat to be exhausted.

### Protection Function

The power supply circuits for +24 VDC and +5 VDC have an overcurrent/overvoltage detection function which is activated if some problem has occurred. If this function is activated, it automatically shuts off the output voltage to protect the power supply circuit. If no DC voltage is output from the power supply circuit because the overcurrent protection function has been activated, turn off the power switch (SW1), disconnect the power cable, rectify the problem with the loads, and then turn on the power switch again. Do not turn on the printer for about two minutes after turning it off. If overcurrent flows in the AC line, the circuit breaker on the circuit is turned on to shut off the output voltage.

## **VIII. Sheet Feeder**

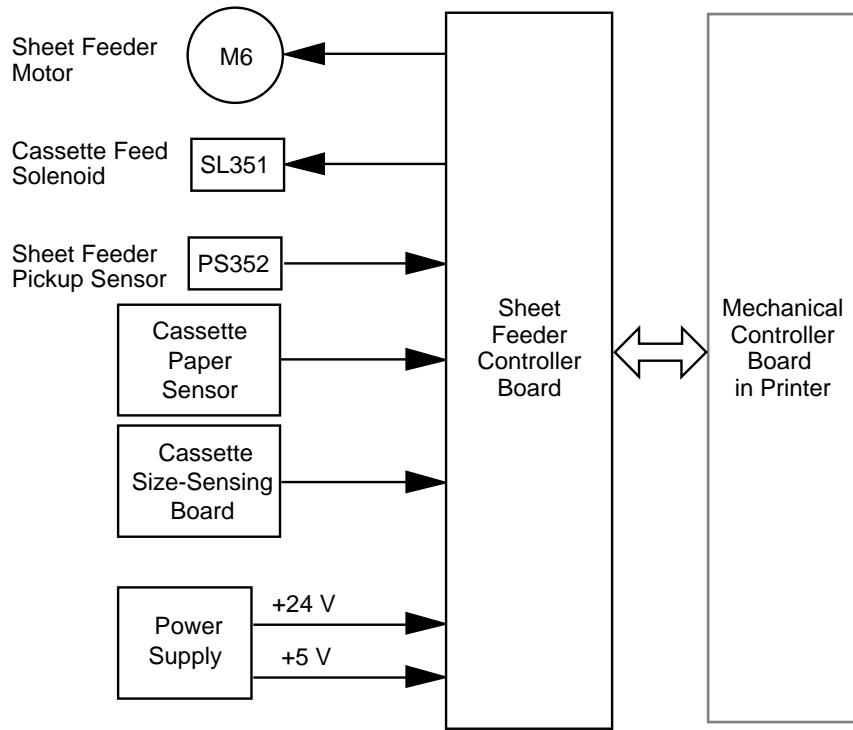
Outline of Electrical Circuit

The sheet feeder is electrically controlled by the sheet feeder controller board in the sheet feeder.

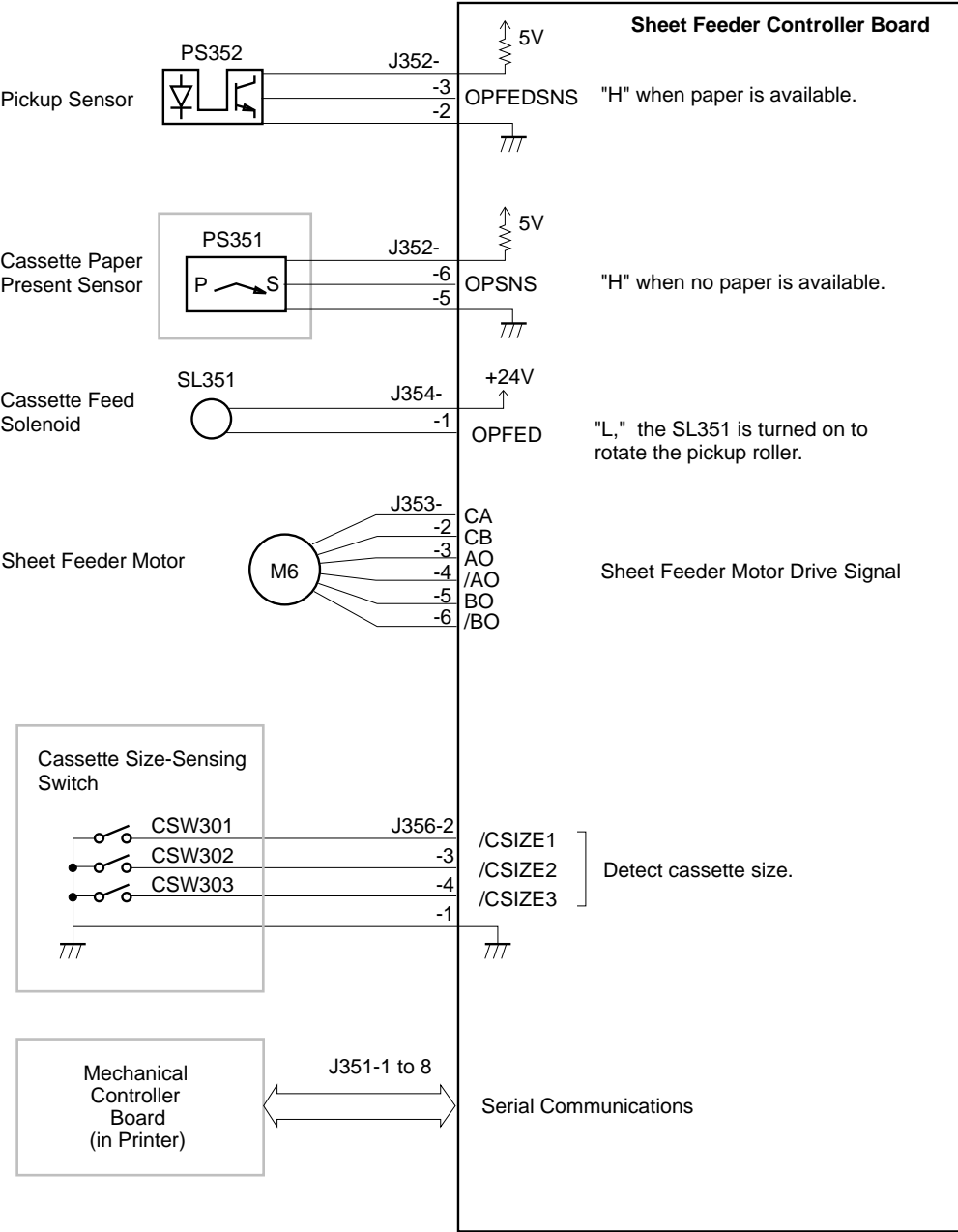
This board provides serial communications with the mechanical controller in the printer and outputs signals to drive the loads of the motors and the solenoids.

The power supply for the sheet feeder consists of +24 VDC generated by the internal power source and +5 VDC supplied by the printer.

The following block diagram shows the correlation between the sheet feeder and the printer.



Sheet Feeder Controller Board Input/Output



Pickup/Feed System

**Outline**                    The sheet feeder pickup roller is driven by the sheet feeder motor (M6). The sheet feeder motor is controlled by the sheet feeder motor driver IC on the sheet feeder controller board. The cassette pickup solenoid is controlled by the sheet feeder driver IC on the sheet feeder controller board.

**Pickup  
Operation**                When the print sequence command is received, the mechanical controller in the printer rotates the main motor (M2). The sheet feeder controller board in the sheet feeder rotates the sheet feeder motor (M6) at high speed. Simultaneously, it turns the cassette feed solenoid (SL351) on to rotate the sheet feeder pickup roller. Thus, paper is picked up. After any multified sheet is separated by the separation roller, the paper is fed into the printer by the feed roller. The sheet feeder controller board detects the paper leading edge with the pickup sensor in the feeder, and changes the speed of the sheet feeder motor to normal when the paper reaches feed roller 2 in the printer pickup block. Thus, one sheet of paper is picked up from the cassette in the sheet feeder.

The following table shows the settings of the cassette size-sensing switches.

Cassette	Cassette Size-Sensing Switch		
	CSW1	CSW2	CSW3
A4	OFF	ON	ON
B5	ON	OFF	ON
LTR	OFF	OFF	ON
LGL	ON	OFF	OFF
Cassette Absent	OFF	OFF	OFF

**Detecting Jams**                Jams during the pickup and feed from the sheet feeder are detected in the same manner as in the printer.



Power Supply

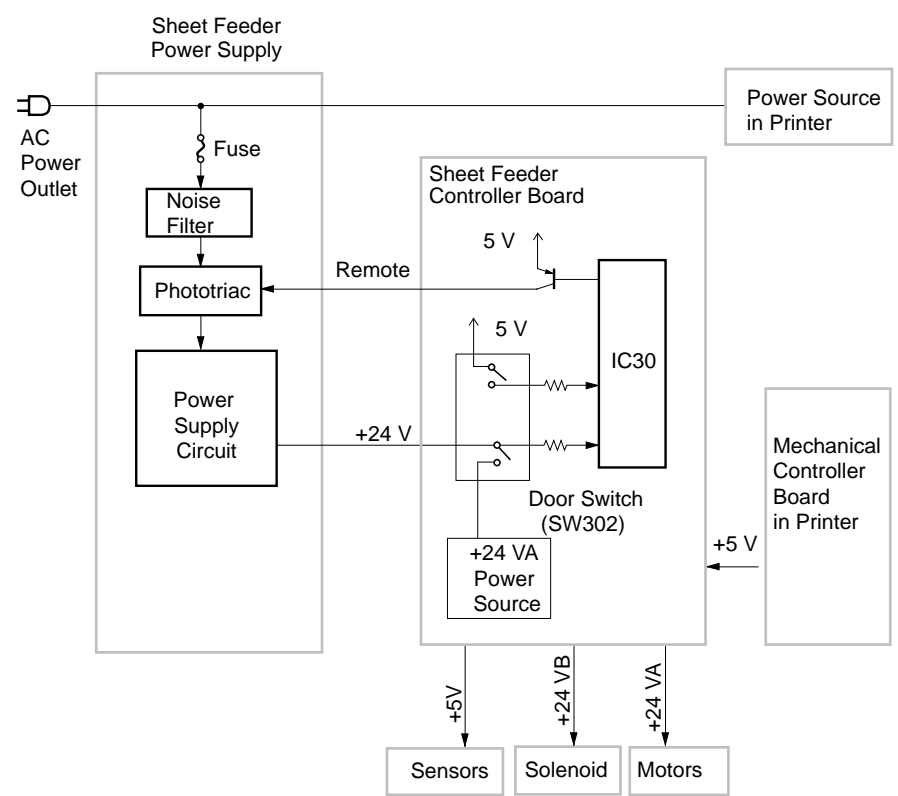
The power supply for the sheet feeder consists of +24 VDC generated by the internal power source and +5 VDC supplied by the printer.

The power source in the printer uses a remote switch. The CPU in the sheet feeder controller board outputs the REMOTE signal to the power source in accordance with a command from the printer and turns the power supply on or off.

A voltage of +5 VDC is used by the sensors and the ICs in the sheet feeder controller board, while +24 VDC is used to drive the motors and the solenoids.

The right door switch (SW302) is on the sheet feeder controller board. When the right door is opened, this switch is turned off to shut off +24 V supplied to the drive loads.

With the sheet feeder installed on the printer, the AC power supply is sent to the power source in the printer via that in the sheet feeder. If the power cable is connected to the AC inlet on the printer by mistake, the AC power supply is not sent to the power in the sheet feeder, nor is +24 VDC for the feeder generated. Therefore, the sheet feeder controller board monitors the supply of 24 VDC by the power source and if 24 VDC is not generated, it informs the mechanical controller CPU in the printer of a sheet feeder +24 V failure. The mechanical controller notifies the DC controller, which then reports an internal communication failure to the I/O controller.



# 2

## Troubleshooting

• • • • •

## Using This Chapter

This chapter is divided into four sections.

### I Preparation and Tips

This section contains troubleshooting checklists, list of recommended tools, circuit diagrams, and tips. If you are working on a Color LaserWriter 12/600 PS for the first time, please take time to read the topic “Verifying Printer Operation.” This topic discusses how to place the printer in an open operational state.

### II Startup Tests and Diagnostics

This section describes the Power-On Self-Test and the Color LaserWriter Service Utility.

### III Flowchart Troubleshooting

This section is geared toward a procedural approach to troubleshooting. If you do not know where to start, or you want to verify printer operation after servicing, go to Flowchart A.

### IV Symptom-Driven Troubleshooting

This section is geared toward a quick-retrieval approach to troubleshooting and contains topics such as “Print Quality Defects” and “Miscellaneous Problems.” This section is designed to expand to cover late-breaking issues that are reported from the field.

## **I. Preparation and Tips**

## Troubleshooting Checklist

Before troubleshooting the printer, make sure that you have checked the following items in the order in which they are listed.

- 1 Make sure that the printer is on a flat, sturdy surface and that it is isolated from vibrations, direct sunlight, or environmental conditions that do not meet specification.



**Caution:** It is extremely important that the printer be on a perfectly level surface. Oil overflow errors can occur due to out-of-level surfaces. See the “Leveling Instructions” addendum at the end of this chapter for complete information.

- 2 Install the photoconductor cartridge and toner disposal box and lower the disposal box cover.
- 3 Examine each cartridge and make sure that its inner workings are locked and cannot turn within the cartridge housing.

**Note:** If you can turn the inner housing to see the toner-coated developing cylinder, the cartridge is not locked. Hold the cartridge in your hands with the dark black inner housing facing up. Turn the inner housing until it clicks into place and cannot turn any more.

- 4 Load each toner cartridge into its corresponding bay.

**Note:** If you cannot install a cartridge, make sure that its sealing tape is removed and that you are installing the cartridge according to the instructions in the user guide. After you load the fourth cartridge, advance the carousel manually another half-revolution to assure that the fourth cartridge is installed correctly.

- 5 Make sure that the fuser oil bottle is installed and that the oil bottle clamp is in an up position.
- 6 Load the cassette tray with paper that is approved for use in this printer and install the cassette into the printer.
- 7 Raise the transfer drum lever and close the front door.
- 8 Close the pickup block door and fuser access door if they are open.
- 9 If you have just run EPOST, remove the loopback test plug from the I/O controller board.
- 10 Plug in the printer.
- 11 If you are on-site with a Macintosh, connect the Macintosh to the AppleTalk connector on the I/O controller board.

## Tools

### Required

The following tools are required for servicing the Color LaserWriter 12/600 PS printer:

- PowerBook computer with AppleTalk connectors
- Color LaserWriter Service Utility with diagnostic interface cable
- Digital multimeter
- Phillips screwdriver (various sizes)
- Medium size flat-blade screwdriver
- Precision flat-blade screwdriver set
- Needle-nose pliers
- Cotton gloves (for use with transfer drum)
- Extraction syringe (for use with the fuser assembly)
- Lint-free paper or cloth
- Photoconductor cartridge tray

### Recommended

The following tools are recommended for servicing the printer:

- Vacuum designed for servicing of xerographic copiers.
- Magnifying loupe
- Dental mirror for inspecting the oil-overflow sensor

**Note:** It is highly recommended that you use magnetized screwdrivers when working on this printer.

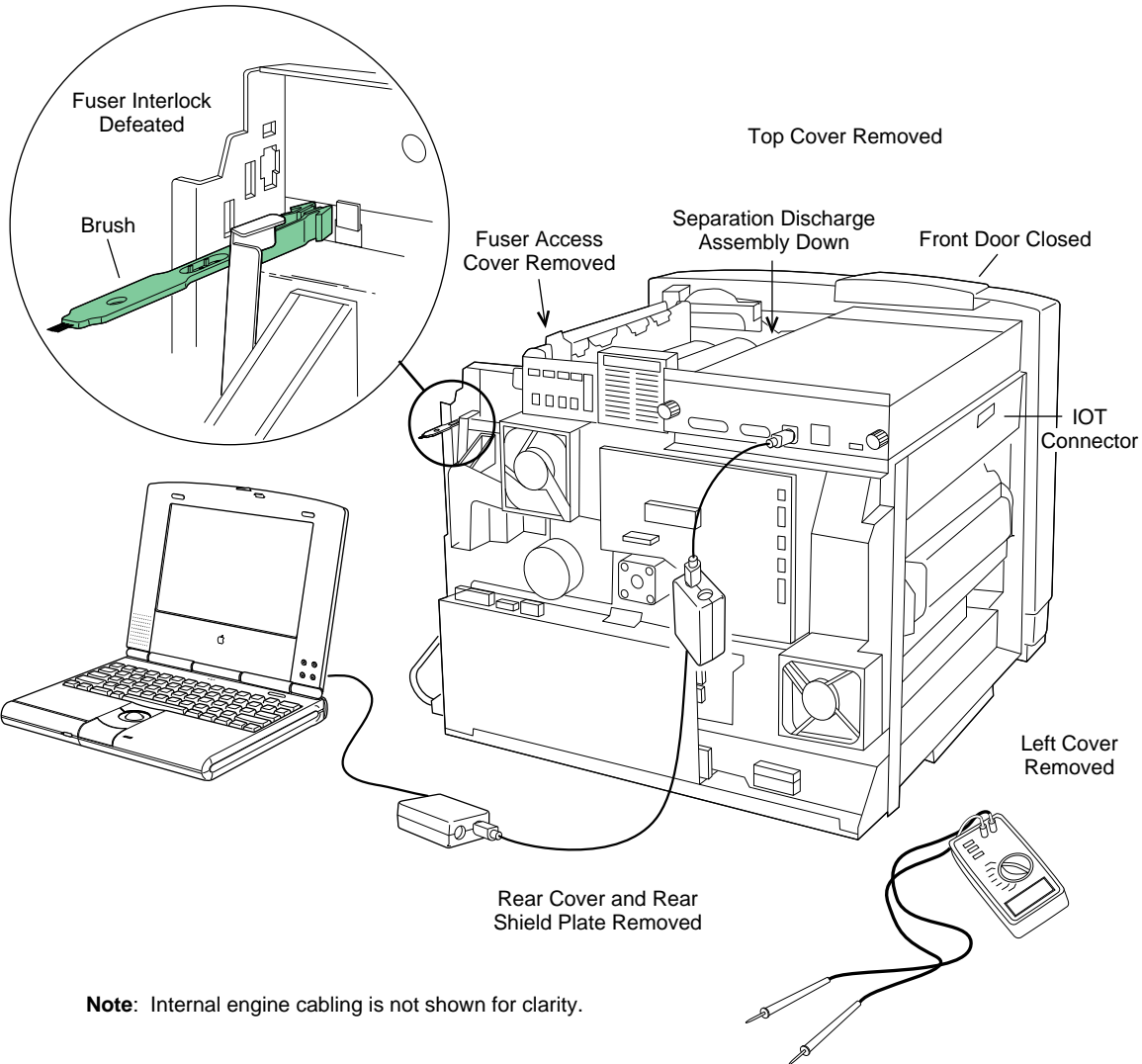
## Verifying Printer Operation

To observe an operational engine, place the printer into the validation state described below. (Refer to the Take Apart chapter for instructions on performing the “First” procedures). The validation state is also the point in reassembly where you should verify printer operation.

**First** Remove the top cover, left cover, rear cover, rear shield plate and fuser access cover. Make sure that all consumables are installed correctly, that the front door and pickup block door are closed, and that the separation discharge assembly is down and resting just above the transfer drum. Plug in the printer.

**Now** Defeat the fuser cover interlock by wedging the green cleaning brush tool between the chassis and the actuator plate.

If you have a PowerBook computer with proper cabling, connect it to either the LocalTalk port on the I/O controller board or the IOT connector on the DC controller board (see “Diagnostic Utility” in this chapter for more information).



**Note:** Internal engine cabling is not shown for clarity.

The printer in validation state is its own best instructional and training aid. When you first have an operational printer in this state, observe as much as you can, paying special attention to the following.

**Door Switch**

Before you turn on power, open and close the doors and observe how the door switch cam assembly works. Only when all three doors are closed will the door switch be pressed.

**Front Door**

With power still turned off, open the front door and advance the toner carousel by pressing and turning the green carousel knob. Observe how the manual rotary assembly meshes with the carousel when you press the knob and how the toner cartridges remain plumb as you rotate the carousel.

As you close the door, observe how the door presses against the knob and elevates the tip of the carousel interlock. Also note the other two actuators that slide into the chassis. The large one nearer the hinge opens the laser shutter and the small one on the right strikes a transfer rod that actuates the door switch.

**Main Motor**

Observe the behavior of the main motor and the three fans. When you see the main motor spin or fans rotate, you know that power is at least getting as far as the mechanical controller board.

**Carousel**

Watch and listen as the carousel rotates to check for presence of toner cartridges. When the calibration tests begin, look between the mechanical controller board and the main fan and observe the bolt action of the cartridge press drive gear. From the right angle, you can also see the carousel through the left end of the printer.

**Fuser Bulb**

Observe how the fuser bulb glows during warmup. This glowing confirms that the fuser bulb circuit is intact.

**Solenoids**

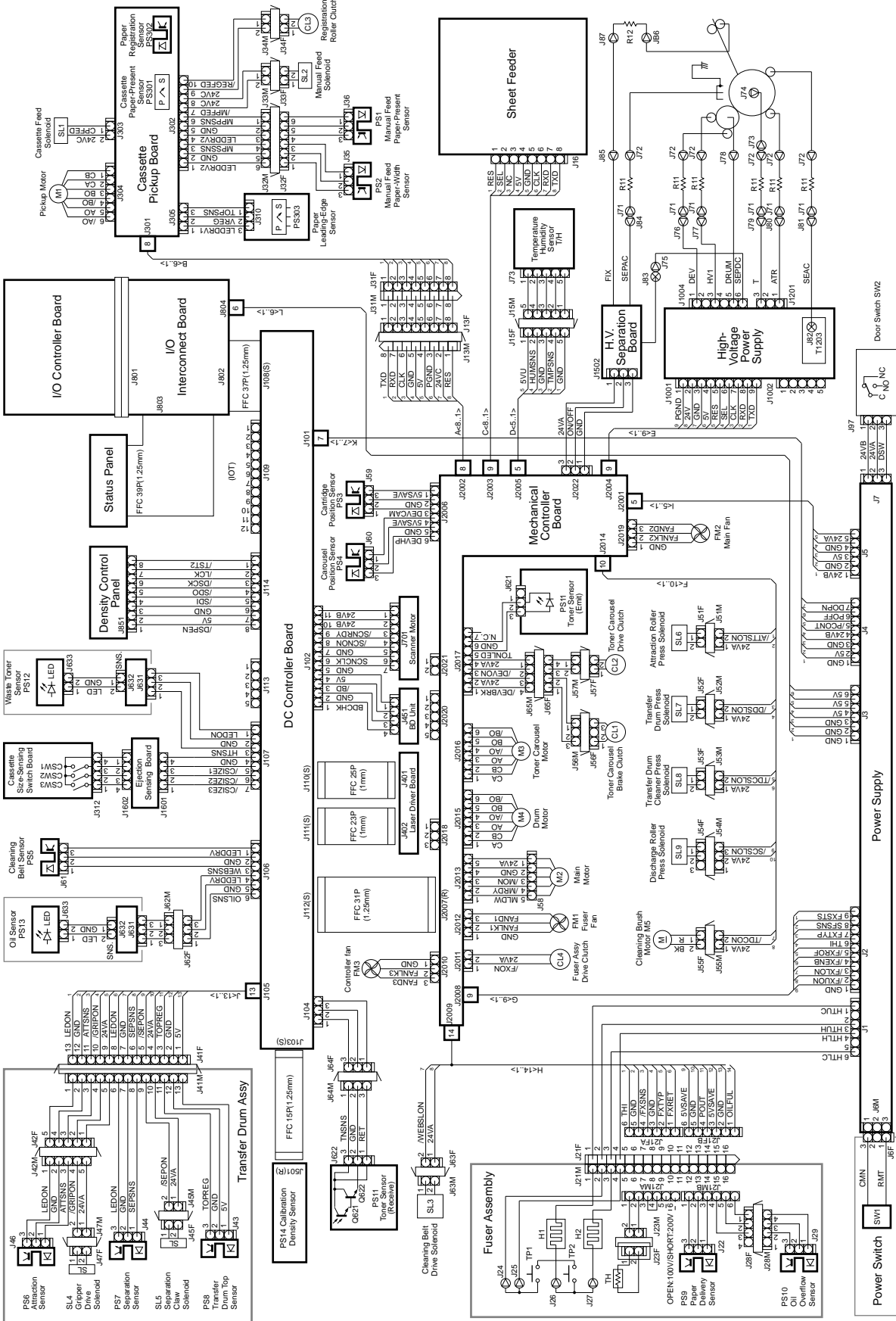
Observe the solenoids as they release press drive into the cleaning brush and discharge roller. At the end of density calibration, observe how the cleaning belt drive solenoid behaves like a small piston to advance the cleaning belt.

**Imaging**

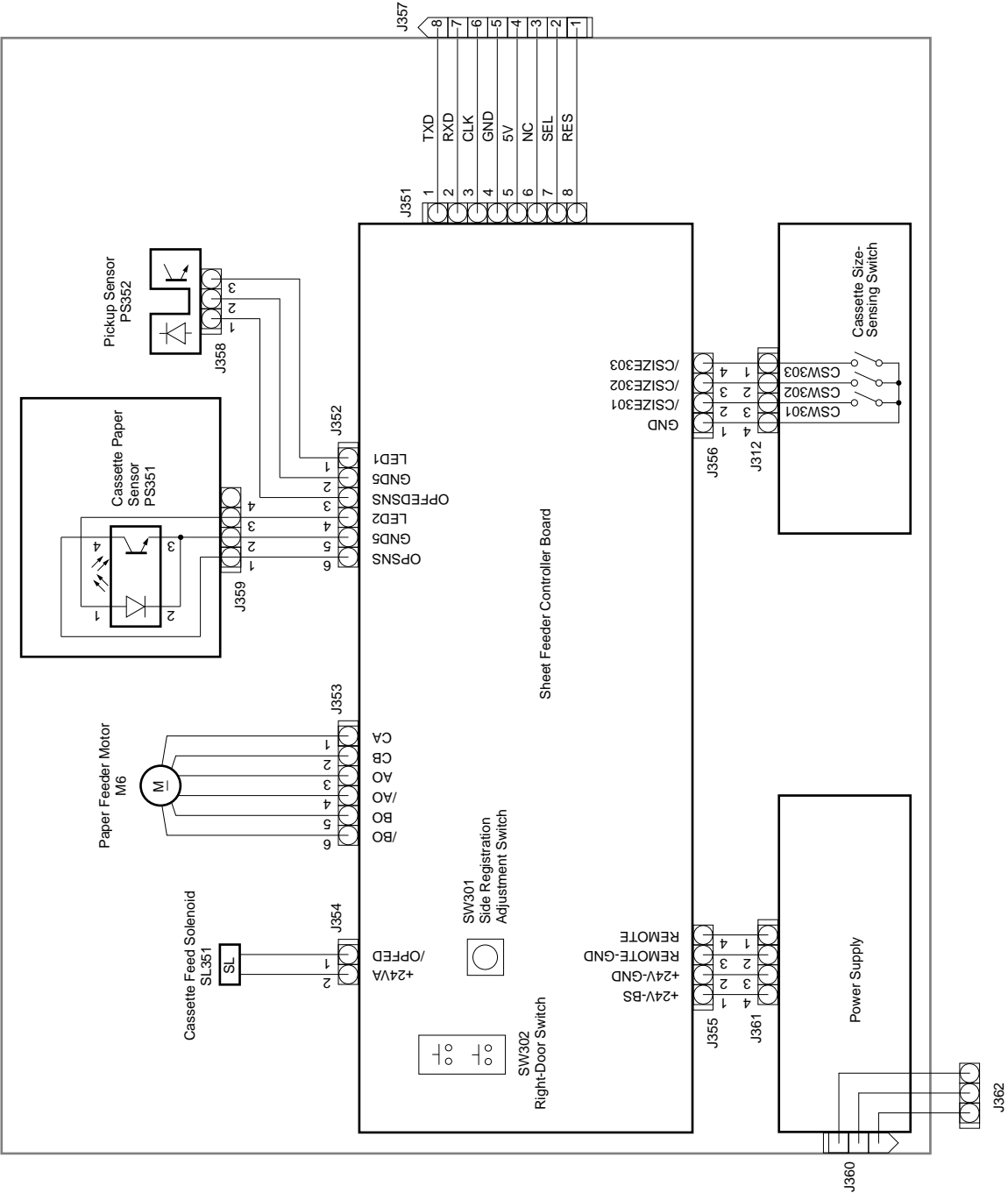
Through the top of the printer, observe the calibration patches being placed onto the transfer drum, and listen as the cleaning brush is powered on to clean off the drum. If the startup page prints, notice the layering of colors as the paper comes to the top of the drum and, finally, how the separation claw actuates to skim the paper from the drum.



Color LaserWriter 12/600 PS Wiring Diagram



Color LaserWriter 12/600 PS Sheet Feeder Wiring Diagram



## Roller Diameters

General

Horizontal print defects that occur repetitively over a single page are almost always caused by dirty or damaged rollers. By measuring the tracks on the page and noting the side of the page that the tracks are on, you can isolate horizontal defects to a specific roller within the printer. The following chart shows the major rollers within the printer and the kinds of defects caused by them.

Roller	Interval on Page	Possible Defects
Upper Fuser Roller	5.27" (134 mm)	Repetitive tracking on front of page
Lower Fuser Roller	5.27" (134 mm)	Repetitive tracking on back of page
Photosensitive Drum	5.07" (129 mm)	Repetitive tracking on front of page
Developing Cylinder	1.96" (50 mm)	Repetitive blank spots or tracking on front of page
Primary Charging Roller	1.49" (38 mm)	Repetitive blank spots or tracking on front of page
Attraction Roller	1.96" (50 mm)	Repetitive tracking on front or back of page
Discharge Roller	1.96" (50 mm)	Repetitive tracking on back of page
Cleaning Brush	3.70" (94 mm)	Repetitive tracking on back of page <b>Note:</b> Faint tracking of calibration patches on the back of the page indicates a problem with the cleaning brush.

## **II. Startup Tests and Diagnostics**

## Startup Tests

When you switch on power, all the status panel lights illuminate briefly. This confirms that power is getting to the status panel and that all LEDs are operational. The lights then extinguish and the four primary lights come back on. This marks the start of the Power-On Self-Test (POST). POST is a set of diagnostic procedures that are written into firmware on the I/O controller board. POST occurs during normal printer startup.

### Power-On Self-Test (POST)

POST checks the following four areas of the printer:

- Stage 1 I/O controller (CPU & SIMMs)
- Stage 2 I/O controller (miscellaneous)
- Stage 3 Printer engine
- Stage 4 Optional hardware

POST extinguishes the primary lights left to right as each test stage passes. In a functional printer, the testing process takes about 40 seconds, after which the normal warmup continues. However, if POST detects a fault during any stage, the status panel enters an error state and flashes the Paper Out and Paper Jam lights forever. At this point, no further printer operation is possible until the fault is resolved.

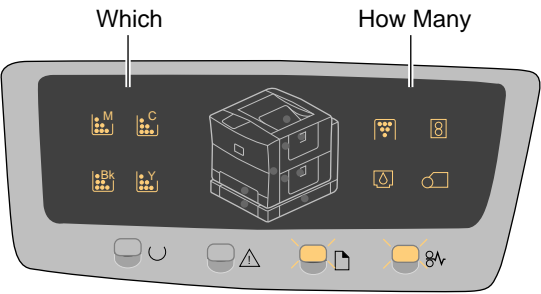


POST/Detected Error



**Note:** The QuickTime movie to the left shows the behavior of the status panel when a POST error is encountered during startup. The “POST Codes Matrix” follows later in this topic.

Observation of the primary lights prior to an error array can be an effective I/O controller confidence test. If the Ready and Consumable lights extinguish during POST, stages 1 and 2 have passed, signifying that the I/O controller is functional.



When the primary POST error array occurs, some combination of secondary lights also illuminates. This secondary array isolates the error designation to the module or piece-part level. To decipher the meaning of the secondary lights, ask yourself two questions: which lights are on to the left of the graphic, and how many lights are on to the right of the graphic? Then refer to the matrix to see what service action is required.

Extended  
POST  
(EPOST)

Some error conditions that stop printer operation cannot be detected within the short period of time that POST runs. When this occurs, the status panel flashes all four primary lights.



POST/Undetected Error

To identify the specific error condition that is causing the “all flashing” array, you must restart the printer under Extended POST (EPOST). This mode simply extends the amount of time given to the testing, so that all errors are detectable. It also reports on jams and consumables. See “EPOST Codes Matrix” later in this topic.

Whereas POST messages can be relayed to you by the customer over the phone, EPOST requires that you be at the printer.

Initiating  
EPOST

To initiate EPOST, you must have the printer loopback test plug (P/N 922-1489). This test plug is colored bright green to differentiate it from the older version black plug. Do not use the black plug on the Color LaserWriter 12/600 PS. It won’t harm anything; it just won’t work.




















































































































**Note:** In order to perform EPOST, the I/O board configuration switch must be in the custom configuration position (to the right). If the switch is to the left, EPOST will not work.






















































































Switch off the printer and install the test plug into the LocalTalk port on the back of the I/O controller board. Switch the printer on. The printer will now behave normally, except that the startup sequence will last longer. In addition, if no error is detected by Extended POST, an EPOST test page will print before control is passed on to the PostScript interpreter.

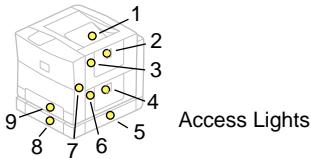


EPOST  
Test Page

**Note:** Remember to remove the loopback plug after running EPOST.

POST Codes Matrix											
⌘ = Flashing											
<p>POST error arrays can occur during normal printer operation. Therefore, customers can observe an array and describe it to you, even though they will not know its significance.</p> <p><b>Important:</b> An error designation does not necessarily mean that the named module is defective—it means that something along the functional path is defective. Please refer to "POST Codes Notes" later in this topic for more information.</p>											
   		Which Toner Lights		How Many Maintenance Lights		Error Designation			Note		
				+		+	0	=	I/O Controller Board		
				+		+	1	=	RAM SIMM 1 (J11)		
				+		+	2	=	RAM SIMM 2 (J10)		
				+		+	2	=	Hard Drive		
				+		+	3	=	ROM Checksum		
				+		+	0	=	Fuser Assembly		
				+		+	1	=	Fuser Oil Pump		
				+		+	2	=	Temp/Humidity Sensor		
				+		+	3	=	Paper Pickup Block		
				+		+	4	=	Calibration Density Sensor		
				+		+	0	=	DC Controller Board		
				+		+	1	=	Power Supply		
				+		+	2	=	Toner Carousel		
				+		+	3	=	Laser/Scanner Assembly		
				+	 	+	0	=	Main Motor		
				+	 	+	1	=	Drum Motor		
				+	 	+	2	=	Scanner Motor		
				+	 	+	0	=	I/O Controller Fan		
				+	 	+	1	=	Fuser Fan		
				+	 	+	2	=	Main Fan		
   	(Unknown error. Run Extended POST to isolate further.) 										17

EPOST Codes Matrix (1 of 2)										
⚡ = Flashing				 ! (With Test Plug)						
Extended POST (EPOST) reports the errors shown in "POST Codes Matrix" plus all the errors shown below and on the next page. Note that EPOST consumable and jam errors do not necessarily correspond to status panel readouts during normal operation.										
					Toner Lights		Access Lights		Maintenance Lights	Error Designation
				+	 ⚡	+	7	+	(none)	Low Magenta
				+	 ⚡	+	7	+	(none)	Low Cyan
				+	 ⚡	+	7	+	(none)	Low Yellow
				+	 ⚡	+	7	+	(none)	Low Black
				+	 ⚡	+	7	+	(none)	No Magenta Cartridge
				+	 ⚡	+	7	+	(none)	No Cyan Cartridge
				+	 ⚡	+	7	+	(none)	No Yellow Cartridge
				+	 ⚡	+	7	+	(none)	No Black Cartridge
				+	(none)	+	7	+	 ⚡	Low Fuser Oil
				+	(none)	+	7	+		Toner Disposal Box Full
				+	(none)	+	7	+	 ⚡	Photoconductor Warning
				+	(none)	+	7	+		Photoconductor End of Life
				+	(none)	+	3	+		No Cleaning Web
				+	(none)	+	7	+		No Photoconductor
				+	(none)	+	7	+		No Fuser Oil
				+	(none)	+	3	+		No Fuser Assembly











































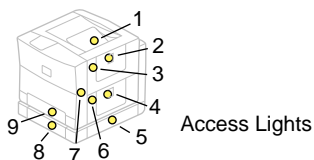


### EPOST Codes Matrix (2 of 2)

⋈ = Flashing



				Toner Lights	Access Lights	Maintenance Lights	Error Designation			
				+	(none)	+	6	+	(none)	Pickup Block Door Jam
				+	(none)	+	7	+	(none)	Front Door Jam
				+	(none)	+	2	+	(none)	Fuser Door Jam
				+	(none)	+	1	+	(none)	Top Access Door Jam
				+	(none)	+	6, 8, 9	+	(none)	Pre-Registration Jam
				+	(none)	+	6, 8, 9	+	(none)	Leading Edge Jam
				+	(none)	+	1, 6, 7	+	(none)	Transfer Grip Jam
				+	(none)	+	1, 7	+	(none)	Transfer Drum Jam
				+	(none)	+	3	+	(none)	Paper Delivery Jam



**POST Codes  
Notes**

The notes below correspond to the “POST Codes Matrix” earlier in this topic.

“Over the phone” denotes actions that you can ask a customer to take to help you isolate faults remotely. “On site” denotes actions you take after you have arrived.

**Important:** DC controller or mechanical controller boards are the intelligence centers of the printer. POST errors in some cases can be caused by a fault in one of these boards. Keep these boards in mind as you isolate faults. In addition, always check the ribbon cable between J2007 on the mechanical controller board and J112 on the DC controller board. Poor connection at either of these two points can cause unpredictable behavior.

**Note 1**

On site, first make sure that the controller and interconnect boards are firmly installed and that the connectors are secure, especially the cable between J802 on the interconnect board and J108 on the DC controller board. Tighten the two screws on the I/O bracket. If the problem persists, replace the I/O controller board.

**Note:** In rare instances, a faulty I/O interconnect board could also return this error.

**Note 2**

Make sure that the SIMMs are securely installed in the correct sockets and match one of the supported configurations listed on page 146 of the User Guide. If the problem persists, replace the SIMM.

**Note 3**

This error indicates that POST detects that the hard drive is present but failing. Make sure that the cable is firmly connected. If the problem persists, replace the hard drive.

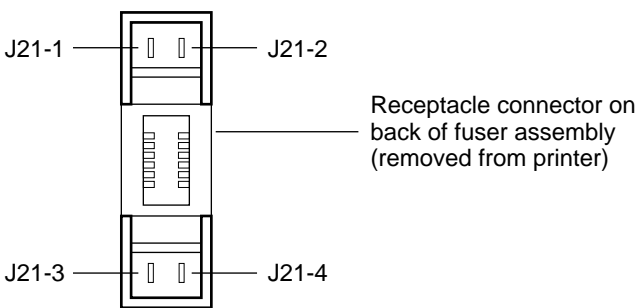
**Note 4**

The DC controller has detected an error in the fuser heater bulb circuit. Over the phone, ask if the customer has just replaced the fuser. If yes, then confirm that the correct voltage fuser was installed and that the two captive screws were fully tightened after installation.

On site, check to see if the fuser bulbs glow during warmup. If the bulbs glow, the power supply is probably okay and the thermistor within the fuser assembly is bad. This suggests replacement of the fuser assembly.

If the fuser bulb doesn't glow, either fuser bulb circuitry is blown inside the fuser, the power supply is faulty, or a connection or cable is bad. First check that J1 (the 4-pin black and white cable), and J2 (the 9-pin yellow cable) are secure at the power supply.

If the connectors are secure, remove the fuser assembly and measure continuity between pins 1 and 2 and then between pins 3 and 4 on the fuser assembly.



A lack of continuity at either point indicates that the fuser heater circuitry is broken, in which case you should replace the fuser assembly. If continuity is confirmed, replace the power supply.

**Note 5**

The DC controller has detected that oil-overflow sensor PS10 is returning low. This is consistent with a condition, in which the oil in the overflow pan floats the actuator upward into the photo-interrupter.

**Note:** If your printer persists in this problem, order the level and shim kit (P/N 076-0622) to assure that the printer is properly levelled. For more information, see [“Overview” in the “CLW 12/660” chapter](#).

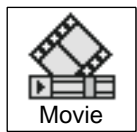
On site, if the printer has just been serviced and has exhibited this error ever since, immediately check connector J2009 on the mechanical controller board. Disconnect J2009, remove it from the cable guides along the top of the board, and then reconnect it. Test the printer.

If the printer has just been moved or tilted, the problem might be that oil has contaminated the sensor. Replace the photo-interrupter (P/N 922-1353) and test the printer.



If the problem persists, open the fuser access door and lower the fuser delivery roller. The actuator for PS10 rises through the “floor” on the delivery side of the fuser roller. If you have a dental mirror, you can place it against the lower fuser roller and get an unobstructed view of the actuator and photo-interrupter. The movie to the left shows how to position the mirror.





If you do not have a mirror, you can remove the two screws and the black trim piece above the fuser roller opening to get a partial direct view of the actuator. The movie to the left is taken from this view, and shows an actuator in the up position being pressed with the tip of a jeweller's screwdriver.

If the flag is up, then oil is filling the pan. Replace the fuser assembly. Make sure to extract oil from both the reservoir and the well before returning the fuser to Apple (see “Fuser Oil Extraction” in Take Apart).

If the flag is not up, then the problem is somewhere between the photo-interrupter and the DC controller. Replace the fuser assembly. If the problem persists, reinstall the customer's fuser assembly and replace the fuser interconnect cable.

#### Note 6

The DC controller has detected an error in the temperature/humidity sensor circuit. On site, check the transit coupling into which the temperature/humidity cable connects (see step 1 of the “Toner Release Assembly” topic in the Take Apart chapter), and check the connection at J2005 on the mechanical controller board. Test the printer.

If the problem persists, replace the temperature/humidity sensor.

**Note:** In rare instances, a faulty temperature/humidity cable or rear DC controller harness cable could also return this error.

#### Note 7

The DC controller has detected an error in the cassette pickup circuit. On site, check to make sure that the cassette pickup assembly mates firmly into the receptacle connector. Check the connection at J2002 on the mechanical controller board. Test the printer.

If the problem persists, replace the cassette pickup board and test the printer. If the problem persists, replace the cassette pickup assembly.

**Note:** In rare instances, a faulty rear DC controller harness cable could also return this error.

#### Note 8

The DC controller has detected an error in the calibration density sensor circuit. On site, check to make sure that the black arm at the end of the density sensing assembly is correctly attached to the top access door, and that there is nothing keeping the assembly from pivoting down and resting above the transfer drum. Check the ribbon cable connection at J103 on the DC controller board and at its opposite end on the sensing assembly.

If the problem persists, replace the density sensing assembly.

#### Note 9

Replace the DC controller board (P/N 661-0898).

**Note 10**

The DC controller has detected incorrect timing at carousel position sensor PS4. This is consistent with a jammed carousel.

Over the phone, ask if the printer has been on-line yet. If it has not, the problem is likely in initial setup, most likely in the handling of the toner cartridges. Make sure that the customer has removed the sealing tape from each cartridge and that the cartridges are correctly installed.



If the printer has been operational, ask if the carousel knob is able to advance the carousel. If necessary, you might also play the carousel rotational sound to the customer. If the knob operates properly, and the customer can confirm carousel movement during startup, the problem is likely with connections or intermittent blockage.

On site, remove the top and left covers. Switch on the printer and try to determine if there is any mechanical drive trying to rotate the carousel. If there is, the printer drive assembly is probably not at fault. If the carousel does rotate, then the toner carousel assembly is faulty only if the position flags on its rear face have been damaged.

If there is obvious blockage of the carousel, clear it if possible. You can remove the toner release assembly if you need better access. Examine the toner carousel interlock. If it is broken, replace it.

If there is no evidence of blockage, reconnect J2006 and J2016 on the mechanical controller board and test the printer. If the problem persists, work inward and confirm the cable connection at the carousel position sensor, replacing the photo-interrupter as required.

**Note 11**

The DC controller has detected an error in the laser/scanner assembly.

On site, check connections at J102, J110, and J111 on the DC controller board and at the connectors on the laser/scanner assembly. Test the printer. If the problem persists, replace the laser/scanner assembly.

**Note:** In rare instances, a faulty cable could also return this error.

**Note 12**

The DC controller has detected a main motor error. On site, remove J2013 from the mechanical controller board and reconnect it. Test the printer. If the problem persists, replace the main motor.

**Note 13**

The DC controller has detected a drum motor error. On site, remove J2015 from the mechanical controller board and reconnect it. Test the printer. If the problem persists, replace the printer drive assembly.

- Note 14** The DC controller has detected an I/O controller fan error. On site, remove J2010 from the mechanical controller board and reconnect it. Test the printer. If the problem persists, replace the I/O controller fan.
- Note 15** The DC controller has detected a fuser fan error. On site, remove J2012 from the mechanical controller board and reconnect it. Test the printer. If the problem persists, replace the fuser fan.
- Note 16** The DC controller has detected a main fan error. On site, remove J2019 from the mechanical controller board and reconnect it. Test the printer. If the problem persists, replace the main fan.
- Note 17** When all four lights flash, there is an error that could not be detected within the short span of POST. There are three errors of this type, the laser/scanner error and certain kinds of fuser and carousel errors.
- Note:** The type of fuser error that flashes four lights during POST will appear as a detected fuser error (yellow + zero) if you switch off and immediately restart the printer.
- Over the phone, ask the customer to restart the printer. If the four lights resume flashing, the problem is probably in the laser/scanner assembly or carousel, in that order. If the fuser error appears, go to note 4.
- On site, initiate EPOST and act on the resulting error code.

## Diagnostic Utility

### Outline

The Color LaserWriter Service Utility is a stand-alone application for the Macintosh that lets you upload and download printer parameters from the DC controller board. You connect your Macintosh to the printer's I/O Test (IOT) connector by means of the utility interface cable (P/N 922-1703).

The IOT connector is J109 on the DC controller board. It is accessible through the left side of the printer (see illustration under “Verifying Printer Operation” in this chapter). If the left cover is in place, you must remove the small IOT access plate built into the cover.

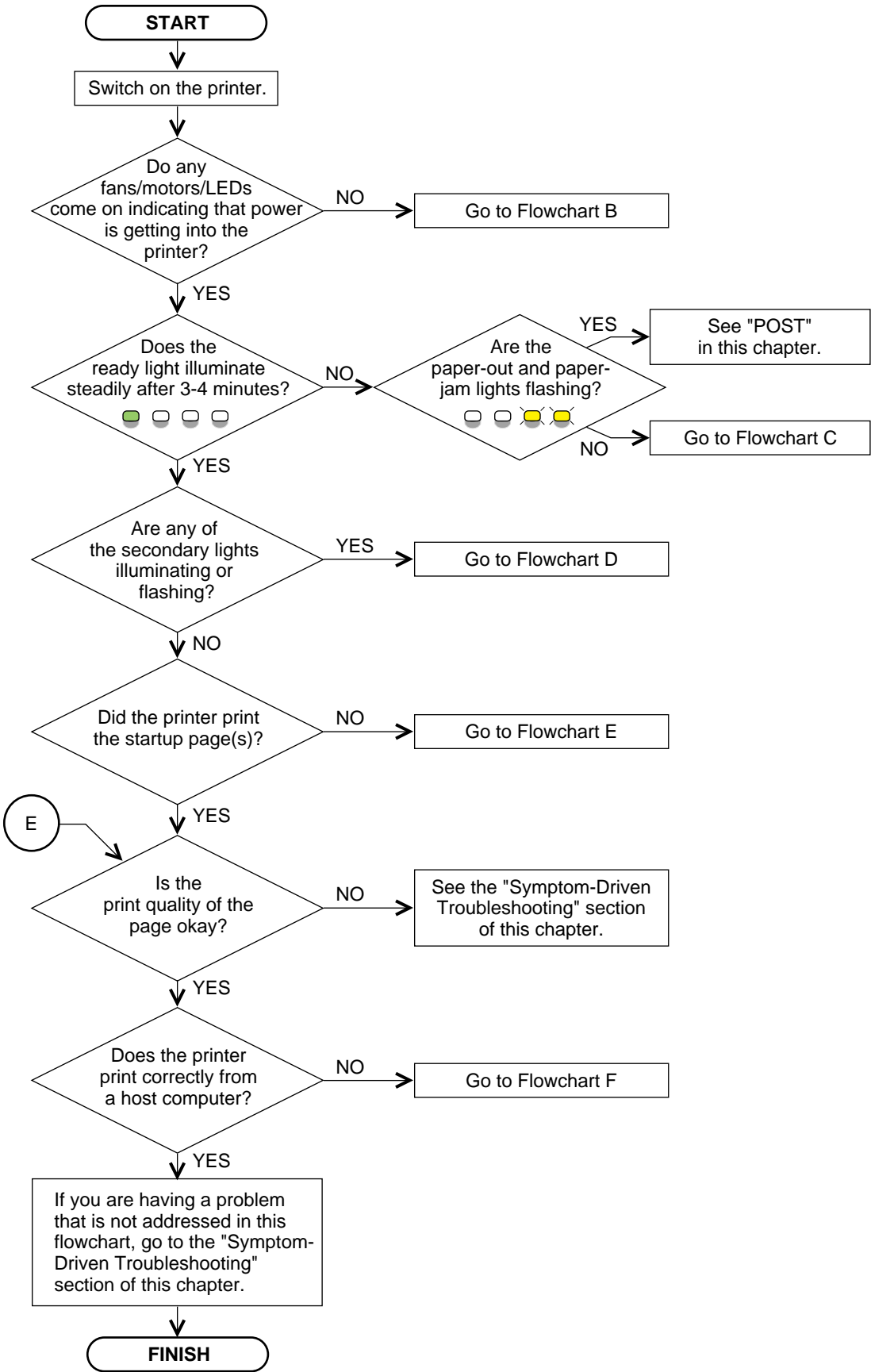
### Availability

The utility can be found on the Service Source Companion CD (path: Diagnostic Utilities, Color LW Service Utility folder). Refer to the ReadMe file within that folder for full information on how to operate this utility.

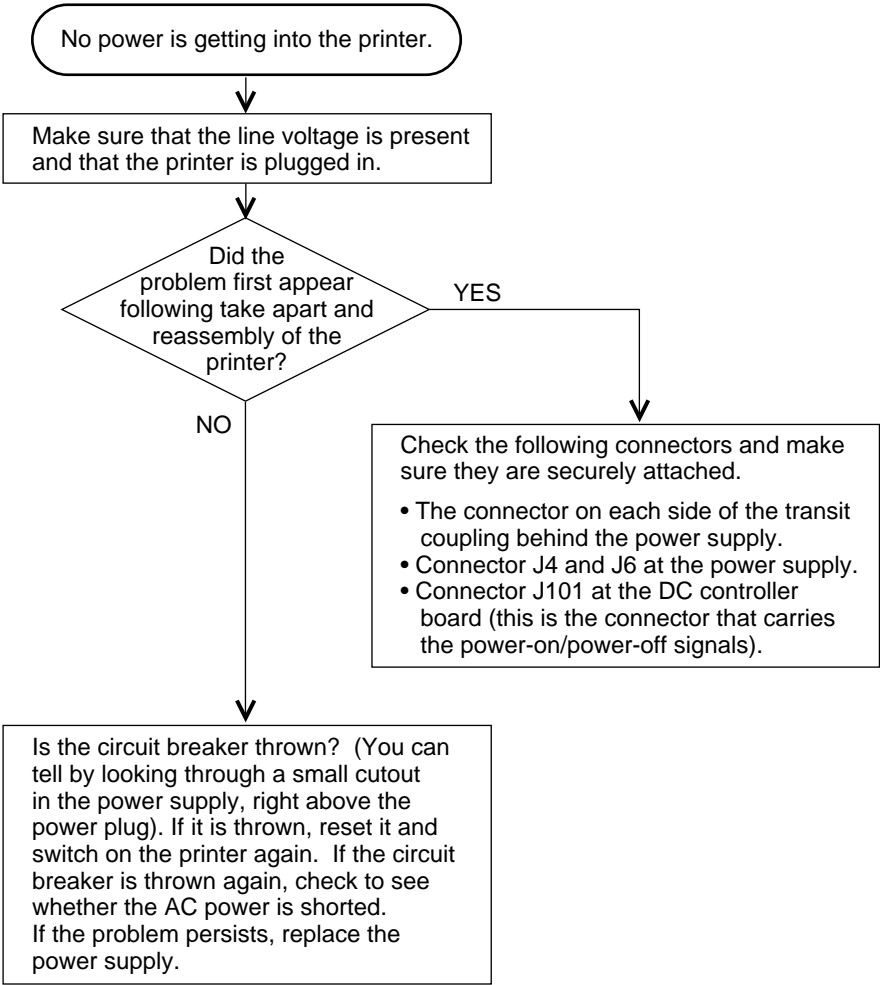
### **III. Flowchart Troubleshooting**



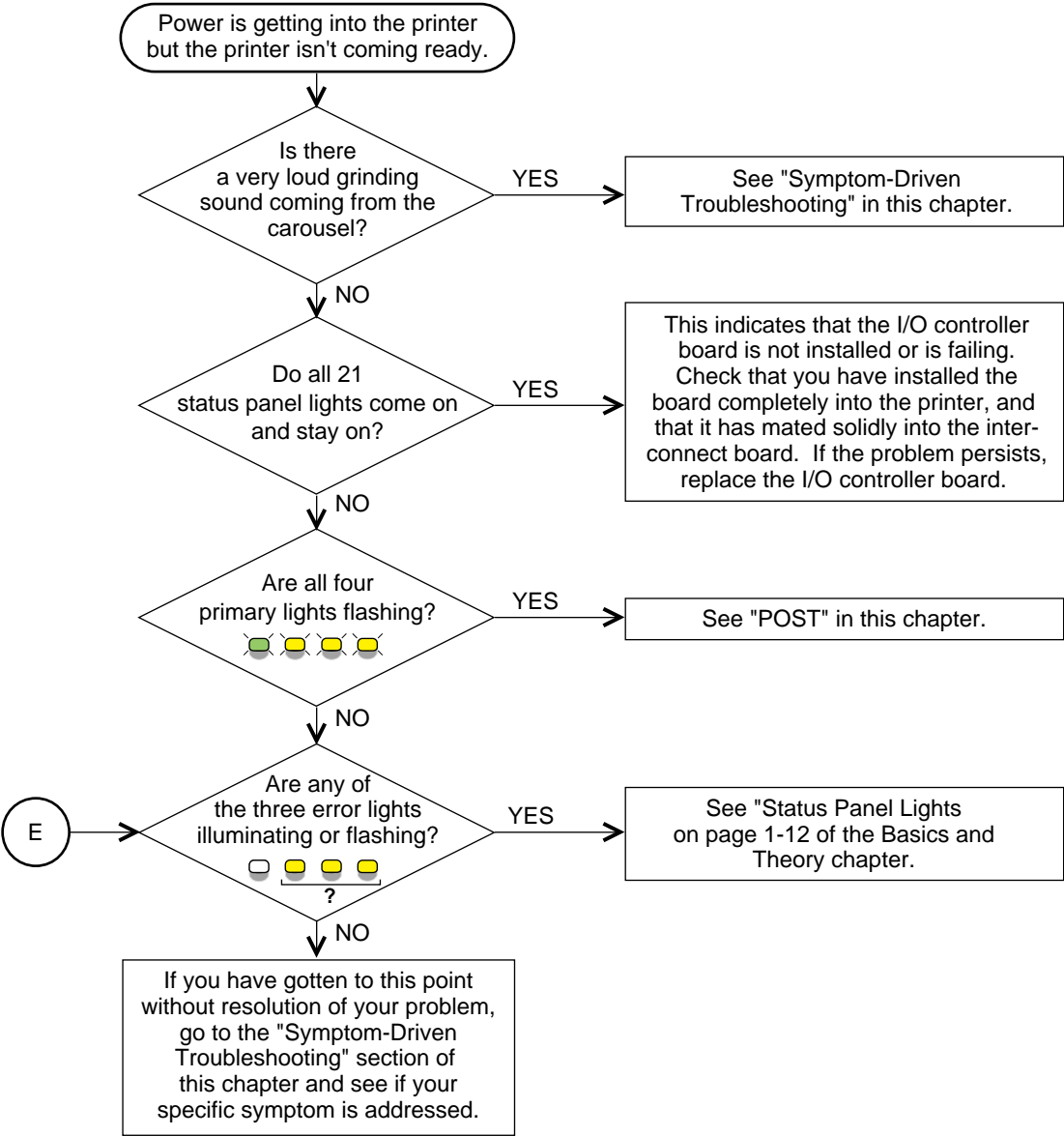
Flowchart A



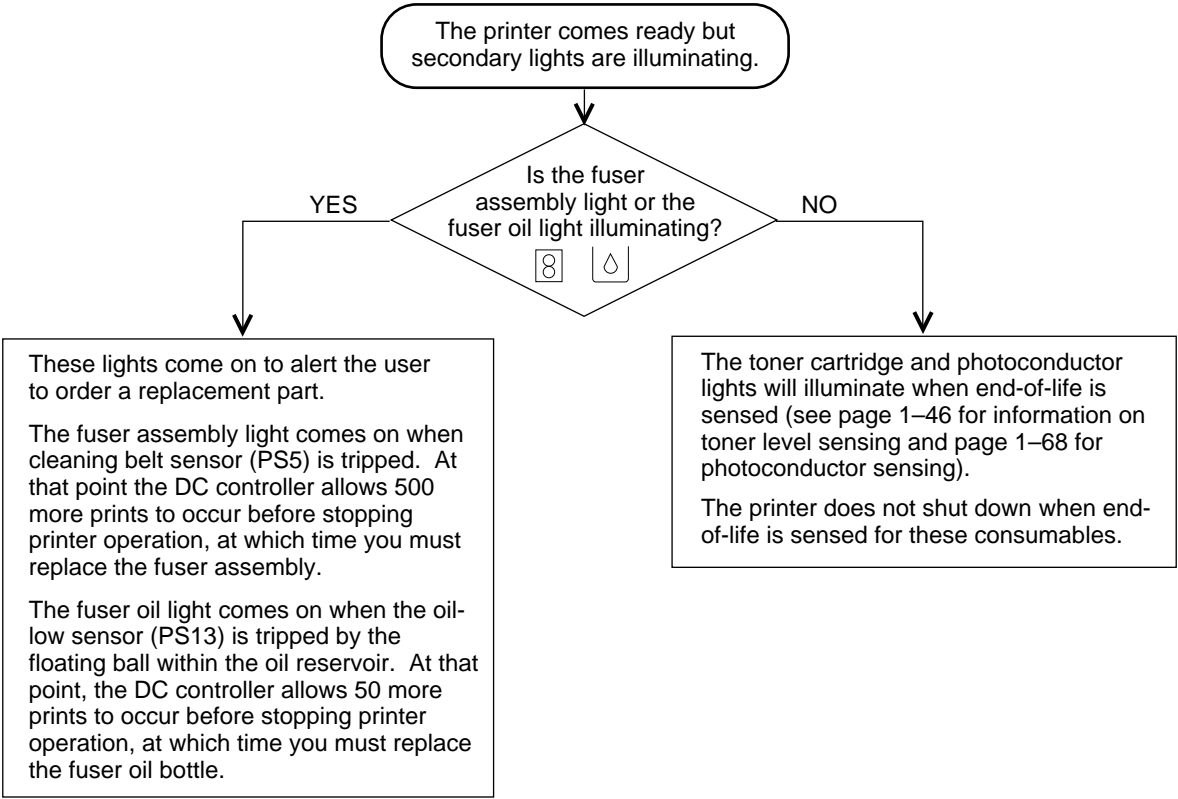
Flowchart B



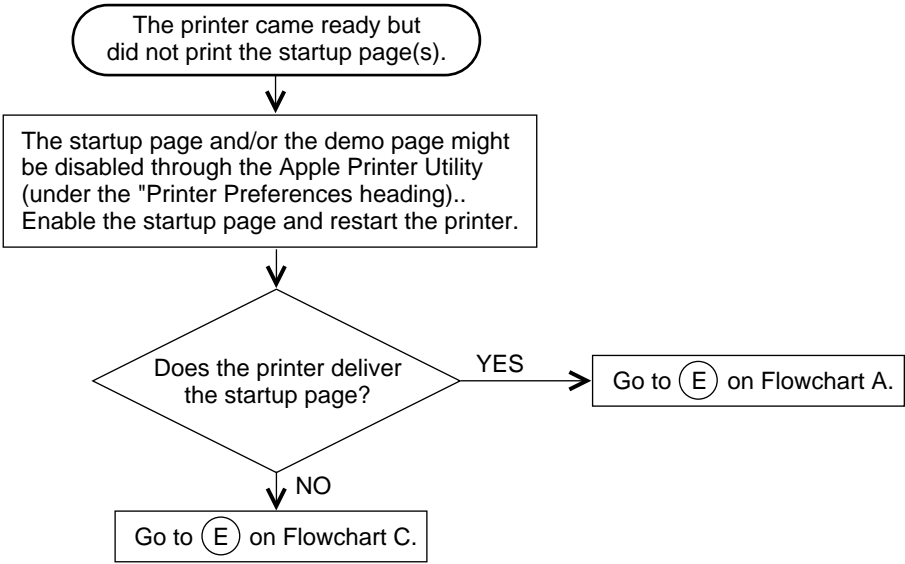
Flowchart C



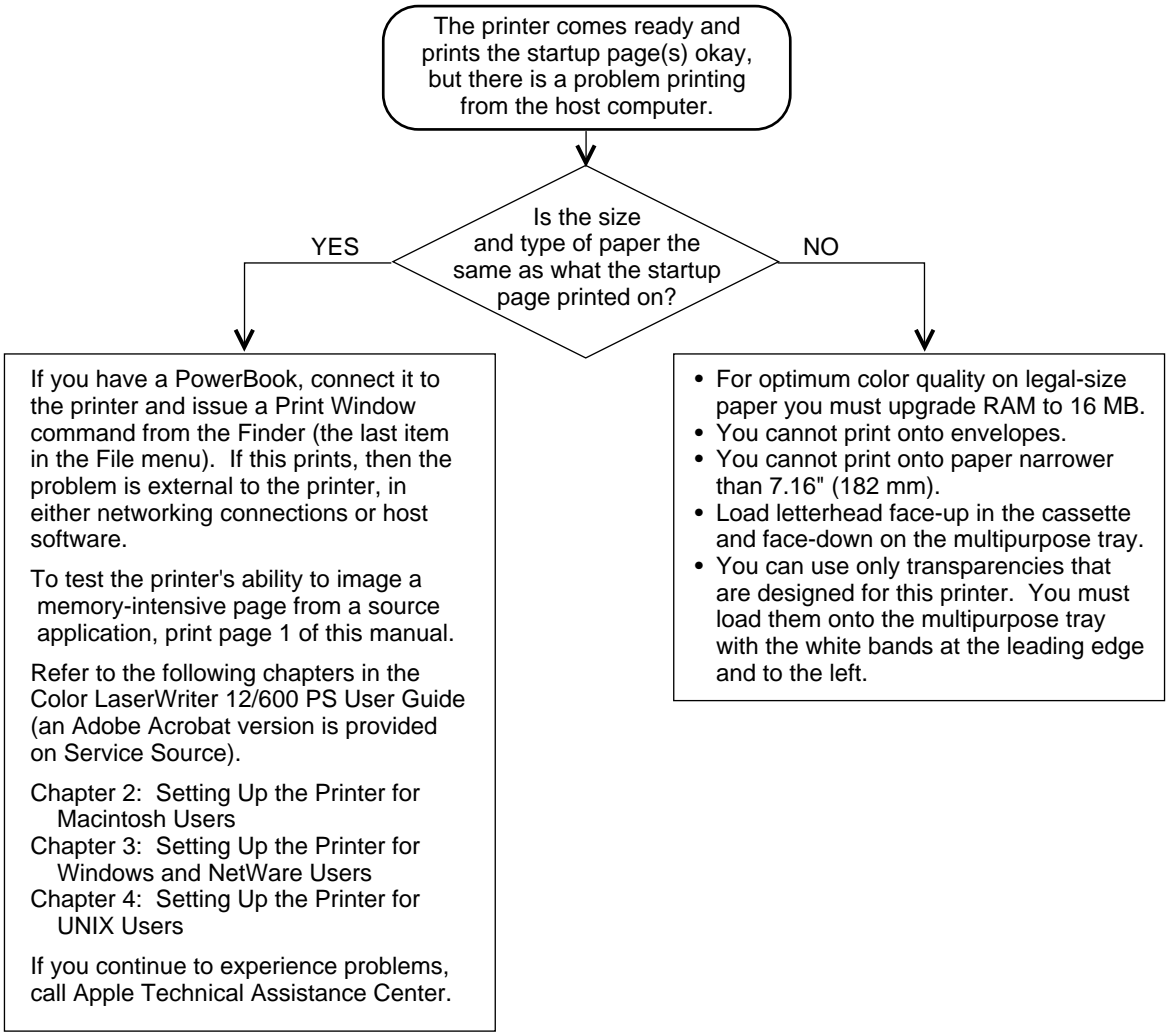
Flowchart D



Flowchart E



Flowchart F



## **IV. Symptom-Driven Troubleshooting**

## Miscellaneous Issues

- 1 The front door opens too easily.

When you open and close the front door with the power on, the DC controller assumes that you have opened the door to clear a jam, and drives the cleaning brush to remove scattered toner. This causes a delay. If you want to tighten the door so that you do not open it inadvertently, perform the “Front Door Latch Adjustment” procedure in the Take Apart chapter.

- 2 High-voltage power plays an extra role.

The Color LaserWriter 12/600 PS is the first printer from Apple in which high-voltage power plays a role in both paper handling and image quality. Inadequate transfer of high-voltage power to the attraction roller, separation discharge assembly, or the transfer drum itself can result in paper jams, while the cutting of high-voltage to imaging rollers can result in blank pages. If you experience such a problem, refer to the lower right corner of the wiring diagram in this chapter. Note what cables are going to what locations, and make sure that all connections and contacts are secure.

- 3 There is a loud grinding sound coming from the toner carousel.

This indicates blockage of the carousel. If the printer has not yet been operational, the problem is likely to be in initial setup, probably in the handling of the toner cartridges. See “Troubleshooting Checklist” for information on locking the internal workings of the cartridge.

If the printer has been operational, and this problem arose suddenly, place the printer into a validation state (see “Verifying Printer Operation” in this chapter). Examine the carousel manual rotary assembly and the carousel interlock. Remove the toner release assembly, if you need more space to clear blockage.

- 4 The paper intermittently jams at the separation claw or doesn’t come off the transfer drum at all.

The problem might be environmental. Force the separation voltage on (see “Density Control Panel” in Chapter 1), and see if the problem improves. This setting will not persist after printer shutdown, so it will need to be reentered.

- 5 Desktop printing software was not installed. What can I do to get it?

Desktop printing software requires System 7.1.1 (Finder 7.1.3) or later. If you have System 7.1, then Print Monitor 7.1.2 has been installed. To get desktop printing capability, install System 7.1.1 or later, and reinstall the Color LaserWriter 12/600 PS software.



- 6 Printer empties paper tray of paper. Output is blank.

Restart the printer and check the calibration patches (as they are printed on the drum, see Troubleshooting/Verifying Operation/Imaging) by opening the top of the printer. If the patches are bands of toner extending across the drum, replace the Laser/Scanner unit.

## Print Quality Issues

This topic addresses general print quality defects that can occur in the Color LaserWriter 12/600 PS. Since color quality is largely subjective and some nuances are nearly impossible to describe, we encourage you to familiarize yourself with all the general issues covered in this topic.

To learn general principles of color theory, go to the “Interactive Color 1.6” folder that is bundled on Service Source CD. This application requires a color Macintosh with screen resolution of 640x480.

**Note:** Best quality paper will yield best results. If color matching is critical, discourage customers strongly from using colored or off-white paper. Avoid recycled paper, if possible.

- 1 Live text prints fine, but equivalent bitmapped text sometimes prints blurry and exhibits a fuzzy halo effect. What is the problem?

When an object gets a full saturation of two colors, the haloing effect normal to all laser imaging is compounded. To offset this, the I/O controller checks incoming fonts and decreases their saturations slightly in cases where unacceptable haloing would otherwise occur. For example, a green font (pure cyan with pure yellow) might be adjusted to 80% cyan and 80% yellow. This adjustment does not visually alter the color.

Since font ID drives this process, bitmapped text is ignored and is imaged as a normal graphic. To offset haloing in graphics, you must make adjustments by hand in the source application.

This same process allows live black text to be imaged in black toner only, instead of 100% saturation of cyan, magenta, and yellow. Live text will be extremely sharp; graphic text will tend to be blurry.

- 2 We have two Color LaserWriter 12/600 PS printers and we get slightly different colors from them. Is there any way to adjust them?

The printer is adjusted at the factory to produce the best possible image quality. If you want to change from these defaults, see “Density Control Panel” in Chapter 1.

- 3 I am getting some banding on my prints.

The term “banding” is generically defined as nonuniform density along the length of the page, and usually appears as some kind of horizontal print defect. Banding can be very difficult to measure but is easily discerned by the human eye.

Banding caused by electrophotographic and high-voltage processes has been minimized in this printer, but will appear in some cases. This banding is a natural function of digital imaging and cannot be completely remedied.

To minimize this effect, try to avoid large flat areas of color, as they will most readily reveal this type of banding, and keep the printer away from machinery that might cause excessive vibration. In addition, take care in maintaining the printer and in keeping it clean and level.

Banding caused by mechanical processes can be remedied. See the print quality issue below.

- 4 There is a repetitive horizontal defect on my pages.

Refer to “Roller Diameters” in this chapter. Defects that repeat at a constant spacing are usually the result of dirty or damaged rollers.

- 5 I am getting oil spots on the paper. What can I do to prevent this?

The purpose of silicone oil is to prevent offsetting of toner onto the fuser rollers. Oil spots on paper should occur infrequently, and then usually on the back of the page. Some factors that are known to increase the incidence of oil staining are

- Failure to remove the orange spacers from inside the fuser access door.
- Turning the printer on and off repeatedly over a short period of time (e.g. five times in an hour).
- A printer coming out of a very long standby mode may exhibit some staining on the first couple of pages.
- Using recycled paper over a prolonged period can plug the oil pan filter which in turn can cause long streaks on the back of the paper.

- 6 I am getting small amounts of toner on the printed page. What can I do to prevent it?

Cleaning the toner off the following areas should eliminate the problem:

- Clean the density sensor and separation discharge wire with the brush provided, as described on page 223 of the user guide. Clean the paper pickup area as described on page 226 of the user guide.
- Print ten blank pages. This will help clean toner off rollers.

- 7 What does the “Best” print quality selection do for the printer?

Selecting the “Best” mode in the print dialog box adds one rotation to the transfer drum (see “Stage 4: Transfer” under “Stages of Imaging” in Chapter 1). This additional rotation occurs before any imaging to allow the paper to fully adhere to the transfer drum. This precaution corrects small registration problems that might occur during the imaging of the magenta layer, the first color that is transferred.

**3**

**Take Apart**

.....

List of Procedures

General

The following pages describe take-apart procedures for the Color LaserWriter 12/600 PS. Listed below are the procedures in the order in which they appear in this chapter. This list is primarily for the benefit of those who have printed this documentation.

If you are viewing this in Acrobat format from a computer screen, you may navigate by bookmarks. Select the bookmarks button in the toolbar (second button from the left), and scroll to find the entry “Take Apart Steps.” Bookmarks remain visible until you close the bookmarks window.

Note that you can zoom in on all graphics to see more detail. Select the zoom button in the toolbar (fifth button from the left) and click anywhere on a page to zoom in.

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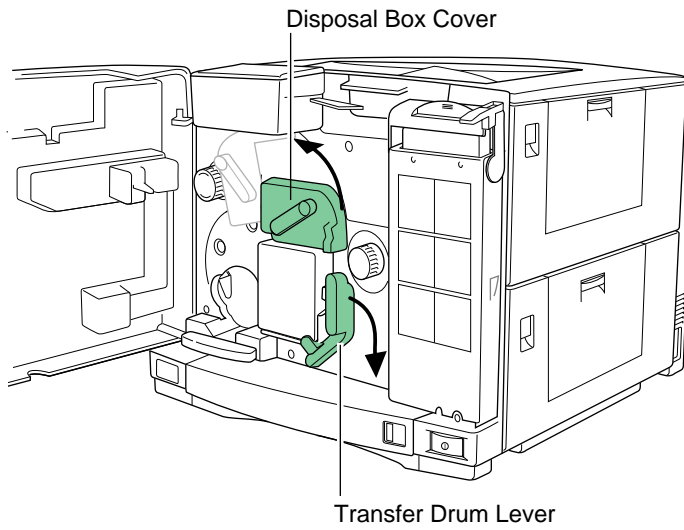
**Toner Disposal Box** (page 1 of 3)**First**

No first steps are required.

**Note:** This part is available as P/N 922-1546. Two toner disposal boxes are also included in Photoconductor Replacement Kit (Finished Goods P/N M3761G/A).

## Toner Disposal Box (page 2 of 3)

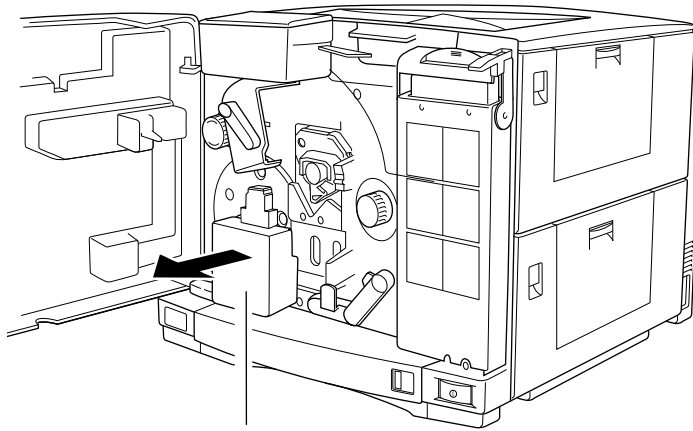
- Now**
- 1 Open the front door. Lower the transfer drum lever and raise the disposal box cover.





## Toner Disposal Box (page 3 of 3)

- 2 Pull the toner disposal box from the printer. Remove the black plastic cap in the side of the disposal box and use it to seal the box.



Toner Disposal Box

**Important:** There is a small safety that drops when you remove the disposal box. Lift this safety before closing the disposal box cover. Do not force the cover shut when the box is absent.

## Photoconductor Cartridge (page 1 of 2)

### First

Remove the toner disposal box and toner cartridges.

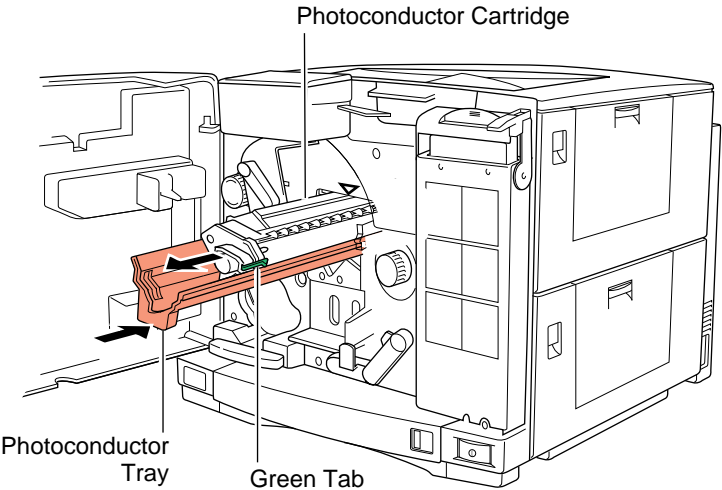
**WARNING:** When you install a new photoconductor, the DC controller board automatically zeros the parameter that tracks photoconductor life. Pulling out a new cartridge and reinstalling the old one may result in an old cartridge being treated as new. If you are considering swapping photoconductors to isolate a problem, you must first capture the controller board parameters. For more information, see “Diagnostic Utility” in Chapter 2.

The photoconductor is light sensitive and subject to damage if special care is not taken during removal. You must use the protective orange photoconductor tray when removing the cartridge from the printer.

The photoconductor cartridge is available only through the Photoconductor Replacement Kit (Finished Goods P/N M3761G/A). The protective tray and two toner disposal boxes are included in this kit. The tray is also available separately as P/N 922-1580. The toner disposal box is available separately as P/N 922-1546.

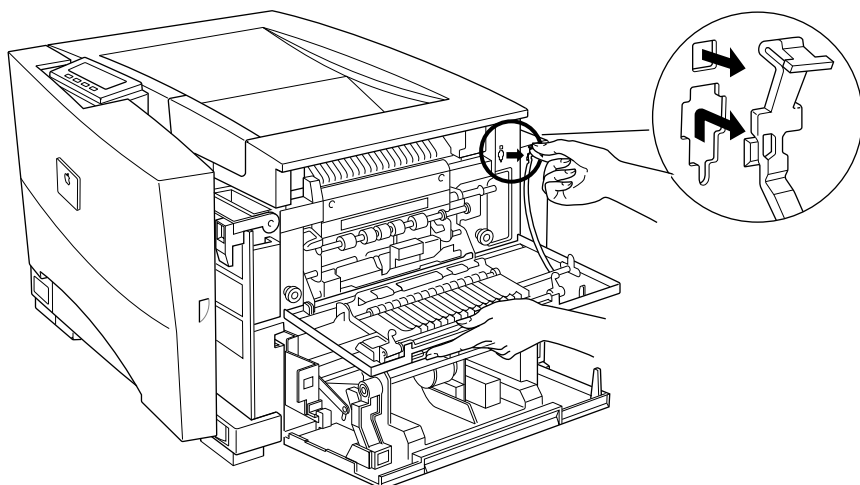
Photoconductor Cartridge (page 2 of 2)

**Now** Place the end of the photoconductor tray on the V-shaped entrance to the photoconductor compartment. Release the green tab on the right edge of the cartridge. Slide the cartridge into the tray, making sure that the tabs on the cartridge track snugly along the top edges of the tray.



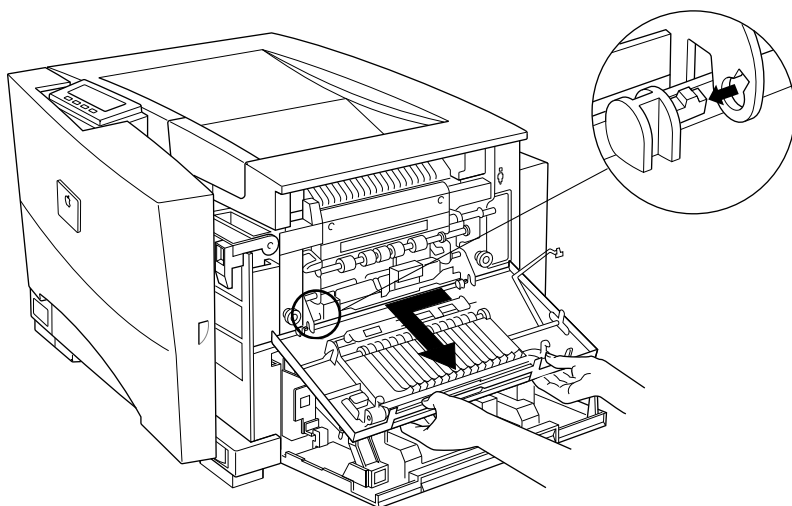
## Fuser Access Cover (page 1 of 2)

- First** No first steps are required.
- Now** 1 Open the front door and the door to the paper pickup area. Open the fuser access cover, and remove the tab that connects the fuser door strap to the chassis.



**Fuser Access Cover** (page 2 of 2)

- 2 Slide the fuser access cover leftward out of its hinge connector and remove the cover from the printer.

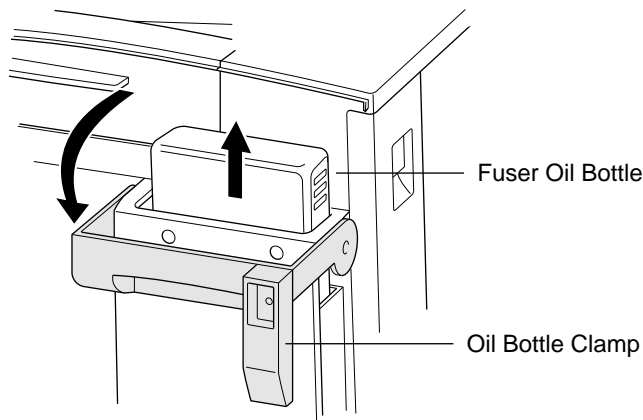


Fuser Oil Bottle (page 1 of 2)

- First

No first steps are required.
- Now

Open the front door and lower the clamp that covers the fuser oil compartment. Lift the fuser oil bottle from the printer.



**Fuser Oil Bottle** (page 2 of 2)

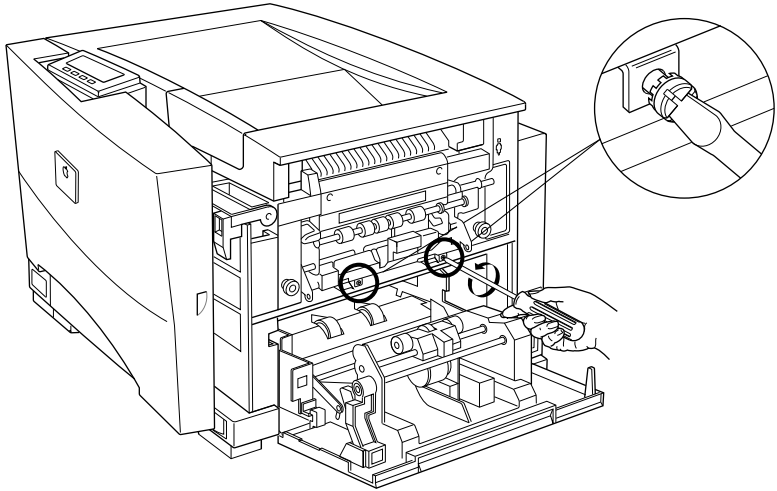
**Note:** There is a mechanism in the lid of the bottle that automatically cuts off flow of oil when the bottle is removed from the printer.

However, some oil might still drip. Be sure to keep the bottle upright and protected by a paper towel as you continue servicing the printer. If any fuser oil spills on the floor, clean it up immediately. The oil is very slippery on hard surfaces.

## Fuser Assembly (page 1 of 3)

**First** Remove the fuser access cover and fuser oil bottle. Open the pickup block door if it is not already open.

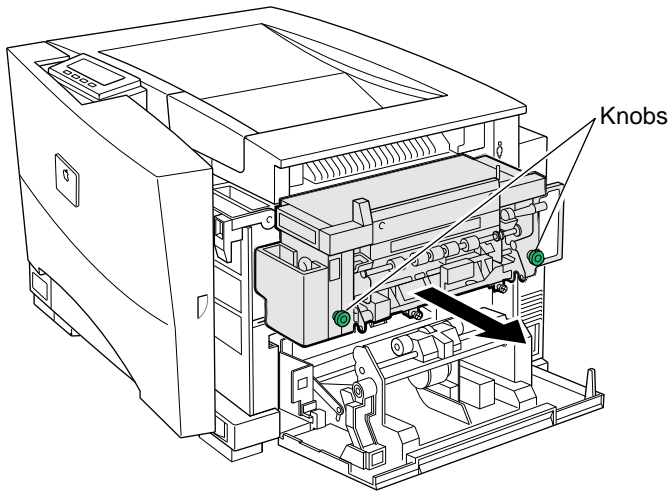
**Now** 1 Loosen the two large locking screws at the base of the fuser assembly. These screws do not come off.





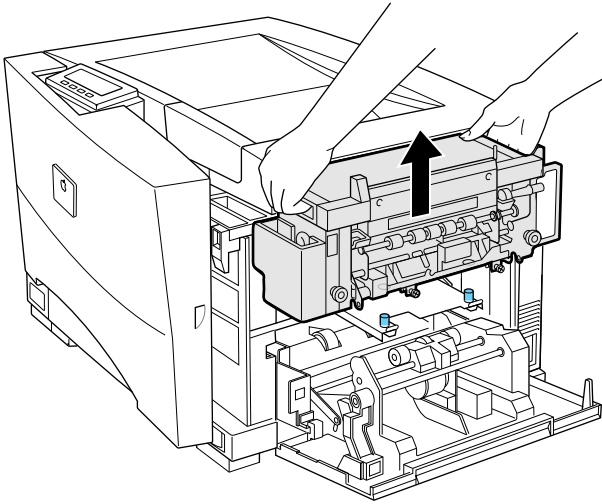
## Fuser Assembly (page 2 of 3)

- 2 Grasp the two knobs and slide the fuser assembly outward.



## Fuser Assembly (page 3 of 3)

- 3 Grasp the two green handles and remove the fuser assembly from the printer.



**Important:** If you are replacing the fuser assembly, perform the “Fuser Oil Extraction” procedure that follows this topic.

## Fuser Oil Extraction (page 1 of 5)

### First

Remove the fuser access cover, fuser oil bottle, and fuser assembly.

#### General Description:

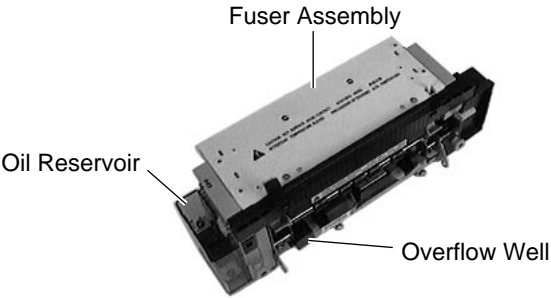
Residual oil remains in the fuser assembly after removal of the assembly from the printer. If you are replacing the fuser assembly, you must extract this oil with a syringe and then seal the oil reservoir before returning the assembly to Apple.

**Note:** One syringe and a sealing block come with the replacement fuser assembly. The syringe is also available separately as P/N 922-1549.

Fuser Oil Extraction (page 2 of 5)

Under normal conditions, you need only extract the oil from the reservoir itself. Step 1 describes the process of extracting oil from the reservoir.

When the control panel lights indicate an oil pump error (see “Power-On Self Test” in Chapter 2), an oil-overflow condition is deemed to exist. In this case, you must also extract oil from the well leading to the oil overflow pan. Steps 2 and 3 describe this procedure.

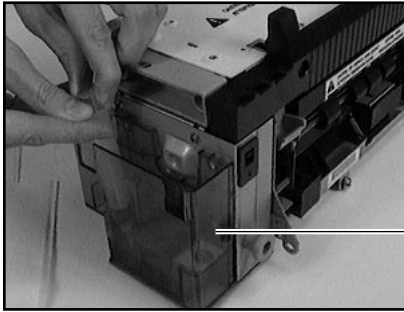


## Fuser Oil Extraction (page 3 of 5)

### Now

Extraction from the oil reservoir:

- 1 Place the tip of the syringe into the oil at the bottom of the reservoir and draw the oil into the syringe. Inject the oil into the reservoir of the replacement fuser assembly. Repeat this step until there is no residual oil left in the bottom of the reservoir. Stopper the reservoir on the old assembly with the sealing block that is provided.



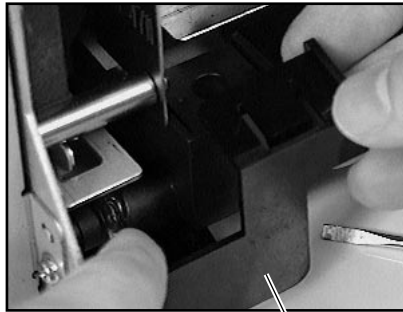
Oil Reservoir

## Fuser Oil Extraction (page 4 of 5)

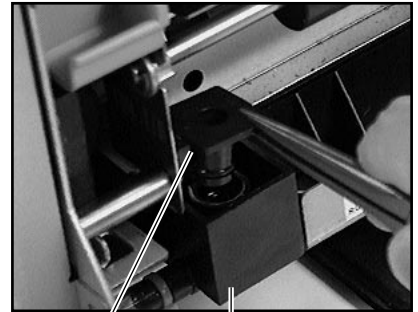
Extraction from the overflow pan:

An oil overflow condition is sensed when a float-type actuator in the overflow pan breaks the photo-interrupter of sensor PS10. The oil that is buoying the actuator can be extracted from the overflow pan through a well located on the delivery side of the fuser assembly.

- 2 Elevate the gear end of the fuser assembly so that oil flows toward the well. Remove the well cover and well cap.



Well Cover

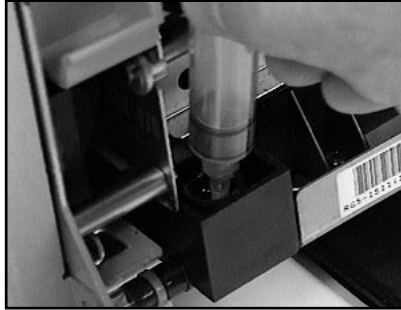


Well Cap

Well

### Fuser Oil Extraction (page 5 of 5)

- 3 Insert the syringe into the center ring of the well and draw the oil into the syringe. Repeat this step until there is no residual oil left in the overflow pan. Replace the well cap and well cover.

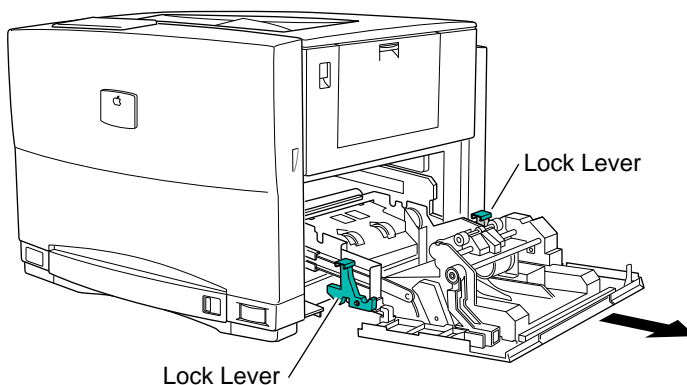


## Paper Pickup Block Removal (page 1 of 2)

**First** No first steps are required.

This procedure covers the removal of the pickup block from the printer. The “Paper Pickup Block Disassembly” topic that follows this topic describes the breakdown of the pickup block into its subassemblies.

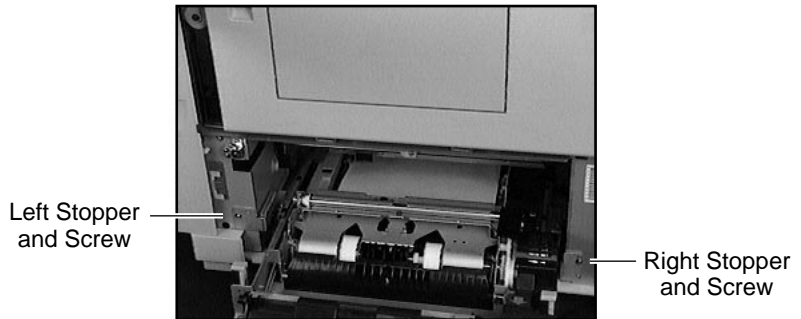
**Now** 1 Open the front door and pickup block cover. Release the green lock levers at each side of the pickup block and slide the block out.





## Paper Pickup Block Removal (page 2 of 2)

- 2 Remove the two silver-colored screws and metal stoppers and remove the pickup block from the printer.



## **Paper Pickup Block Disassembly** (page 1 of 11)

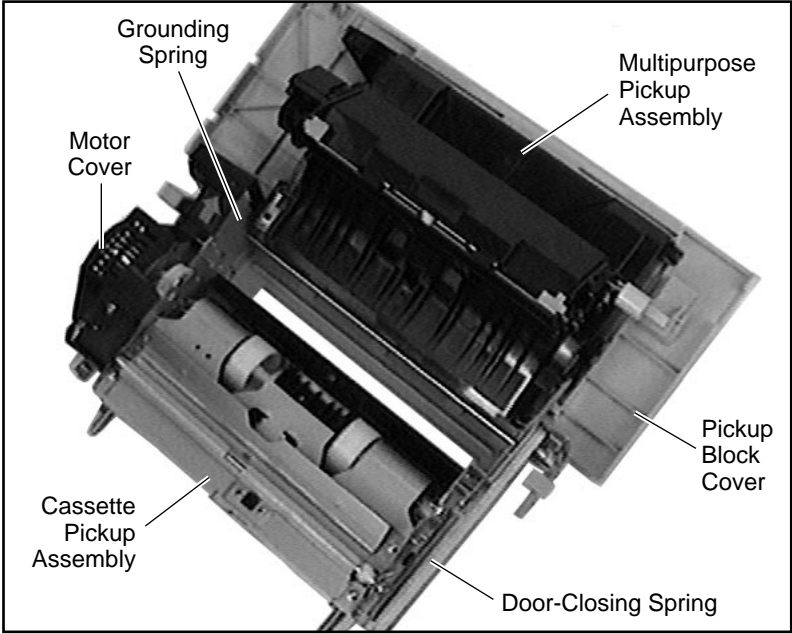
### **First**

Remove the paper pickup block.

The paper pickup block consists of about a dozen parts, the two major ones being the cassette pickup assembly and multipurpose pickup assembly. Perform this procedure if you need to break down the pickup block into these two assemblies.

Paper Pickup Block Disassembly (page 2 of 11)

Paper Pickup Block

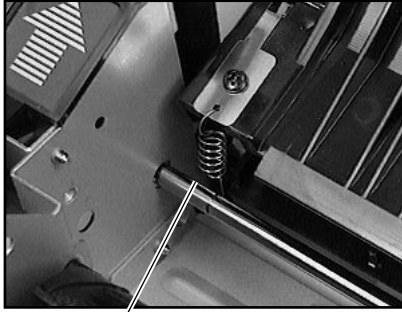


## Paper Pickup Block Disassembly (page 3 of 11)

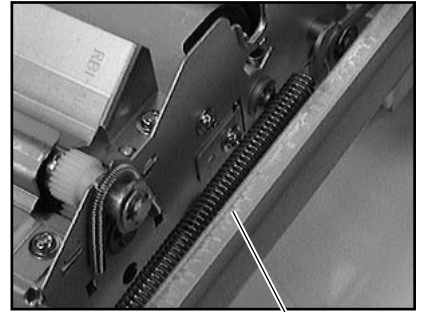
### Now

- 1 Remove the door-closing spring and the grounding spring from the paper pickup block.

**Note:** These two tension springs are not a part of either of the two pickup assemblies, but are available as part of the paper pickup block kit (P/N 076-0500).



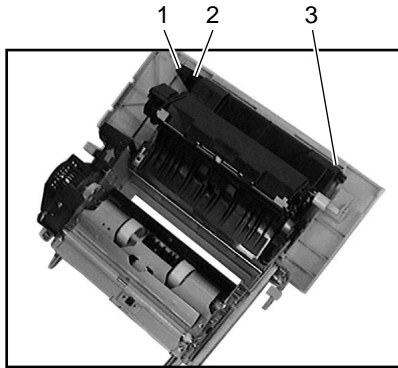
Grounding Spring



Door-Closing Spring

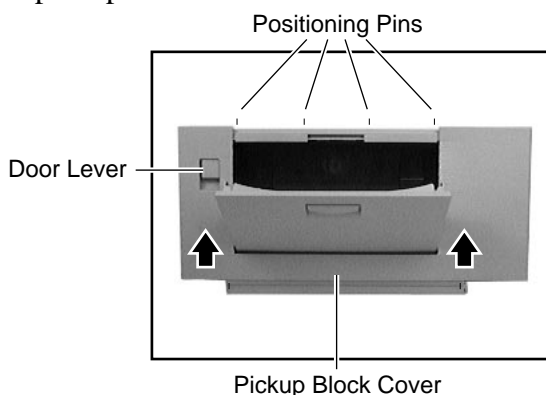
## Paper Pickup Block Disassembly (page 4 of 11)

- 2 Open the manual feed tray and remove the three black screws that secure the pickup block cover to the pickup block.



## Paper Pickup Block Disassembly (page 5 of 11)

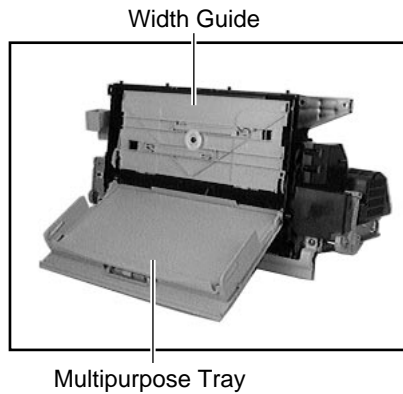
- 3 The pickup block cover is held in place by two posts at the bottom of the pickup block and four positioning pins along the top edge of the block. Shift the pickup block cover upward to clear the positioning pins, thread the door lever through the opening, and remove the cover from the pickup block.



**Note:** The pickup block cover is available as P/N 922-1305. One of the actuators for door switch SW2 is a part of this cover.

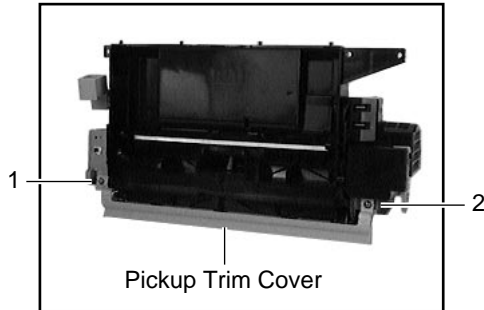
## Paper Pickup Block Disassembly (page 6 of 11)

- 4 Separate the width guide from the multipurpose tray by flexing the guides and releasing the two pins. Deflect the multipurpose tray to release its hinge pin and remove the tray from the pickup block. Lower the width guide to its maximum and slide it off the pickup block.



## Paper Pickup Block Disassembly (page 7 of 11)

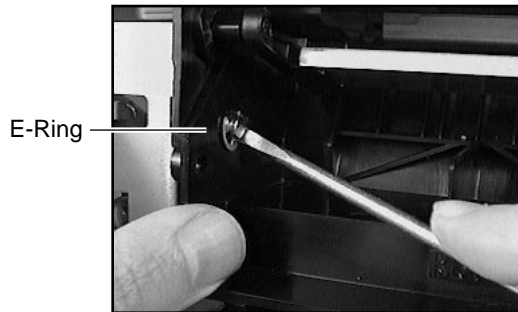
- 5 Remove the two brass-colored screws that secure the trim cover to the pickup block. There are three slider tabs on the trim cover that mate into the bottom edge of the pickup block frame. Pull the trim cover out and down to clear the tabs and remove the cover from the pickup block.





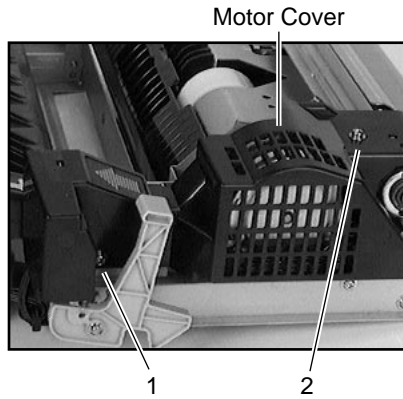
## Paper Pickup Block Disassembly (page 8 of 11)

- 6 Remove the E-ring that secures the hinge arm to the multipurpose pickup assembly. Unpin the hinge arm from the multipurpose pickup assembly.



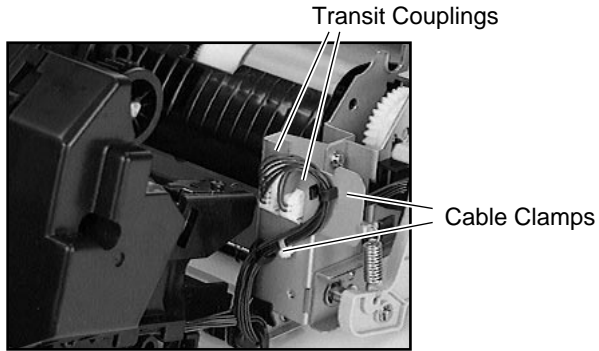
## Paper Pickup Block Disassembly (page 9 of 11)

- 7 Remove the two brass-colored screws and remove the motor cover from the cassette pickup assembly.



## Paper Pickup Block Disassembly (page 10 of 11)

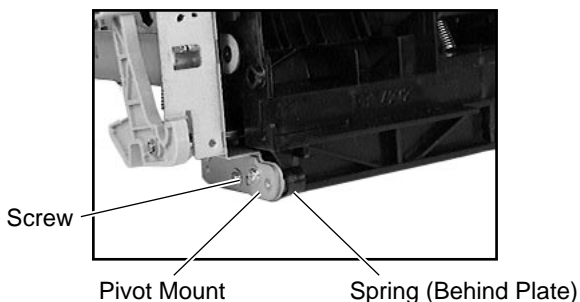
- 8 Disconnect the two connectors from the transit couplings and free the cables from the two clamps.



## Paper Pickup Block Disassembly (page 11 of 11)

- 9 Remove the silver-colored screw that secures the small pivot mount to the front left edge of the pickup block. Slide the mount off the block. While carefully holding the pivot mount spring in place, separate the cassette pickup assembly from the multipurpose pickup assembly.

**Note:** The pivot mount and the pivot mount spring and screw are not a part of either of the two pickup assemblies, but are available as part of the paper pickup block kit (P/N 076-0500).



## Cassette Pickup Assembly

Perform the “Paper Pickup Block Disassembly” procedure. After splitting the pickup block as described in that procedure, the cassette pickup assembly is one of the parts that remains. Note that the following pieces are not contained in the cassette pickup assembly:

- Pickup motor cover (P/N 922-1323).
- Paper pickup block kit (P/N 076-0500), which contains the door-closing spring, grounding spring, pivot mount, and pivot mount spring and screw.

## **Multipurpose Pickup Assembly** (page 1 of 2)

### **First**

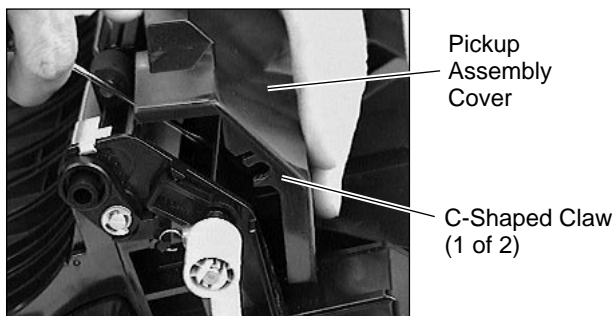
Remove and disassemble the paper pickup block.

After splitting the pickup block as described in the “Paper Pickup Block Disassembly” topic, the only task remaining is the removal of the pickup assembly cover. This cover is not a part of the multipurpose pickup assembly, but is available separately as P/N 922-1324. It is held in place by two C-shaped claws that grip the metal shaft beneath the cover.

## Multipurpose Pickup Assembly (page 2 of 2)

### Now

With a flat-blade screwdriver, pry the claws free of the shaft and remove the cover from the multipurpose pickup assembly.



## Cassette Pickup Assembly Board (page 1 of 4)

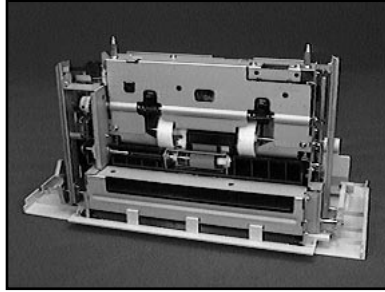
### First

Remove the paper pickup block.

The cassette pickup assembly board is a part of the cassette pickup assembly but is also available separately as P/N 922-1311. All functions of the paper pickup block route through this board. This board contains the photo-reflectors for the cassette paper-present sensor PS301 and paper leading-edge sensor PS303, and the photo-interrupter for paper registration sensor PS302.

### Now

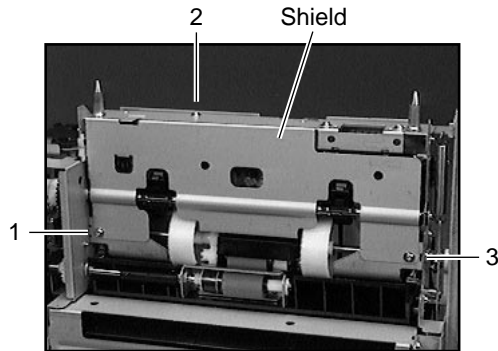
- 1 Set the pickup block flat on its cover so that the two bullet-shaped positioning rods are pointing straight up.





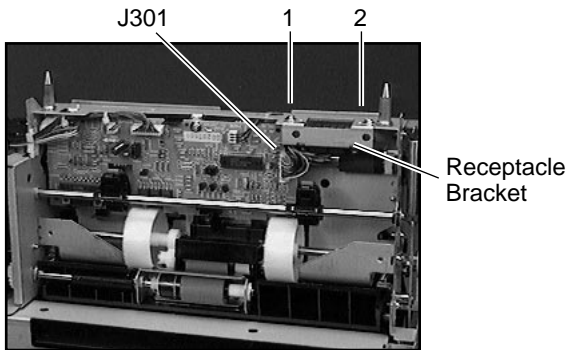
## Cassette Pickup Assembly Board (page 2 of 4)

- 2 Remove the three silver-colored screws that secure the shield to the pickup block and lift the shield from the block.



## Cassette Pickup Assembly Board (page 3 of 4)

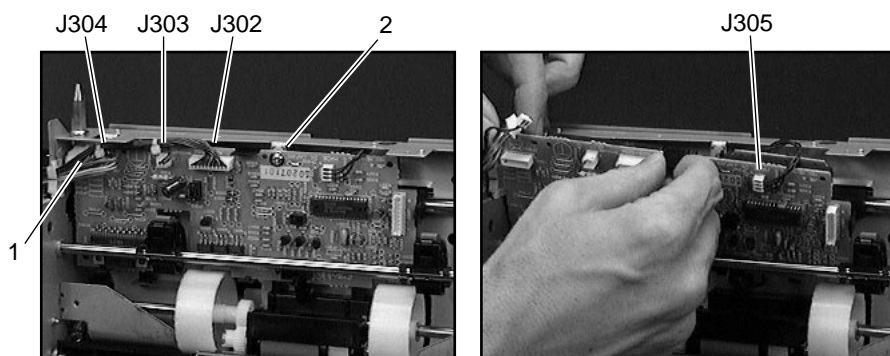
- 3 Disconnect J301 from the pickup board and remove the two silver-colored screws that secure the receptacle bracket to the pickup block. Remove the bracket and cable from the pickup block.



## Cassette Pickup Assembly Board (page 4 of 4)

- 4 Disconnect connectors J302, J303, and J304 and remove the two silver-colored screws. Carefully remove the board from the pickup block.

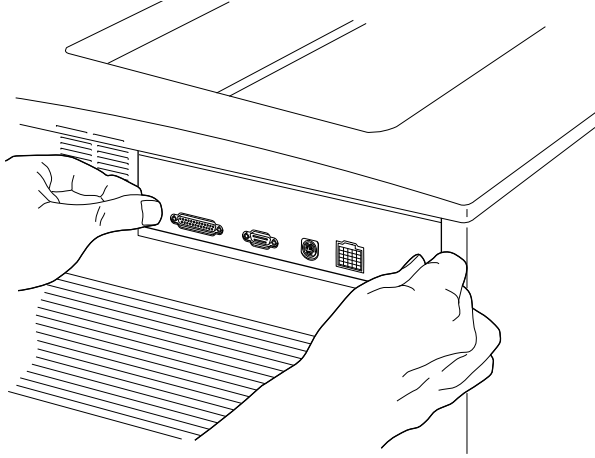
**Note:** Do not disconnect J305 from the pickup assembly board. J305 connects to a small daughterboard on which the photo-reflector for paper leading-edge sensor PS303 is mounted. This small board is a part of the cassette pickup assembly board (P/N 922-1311).



**Replacement Note:** Engage the three claws at the bottom of the board.

## I/O Controller Board (page 1 of 2)

- First** No first steps are required.
- Now**
- 1 Loosen the two captive screws and slide the I/O controller board from the printer.

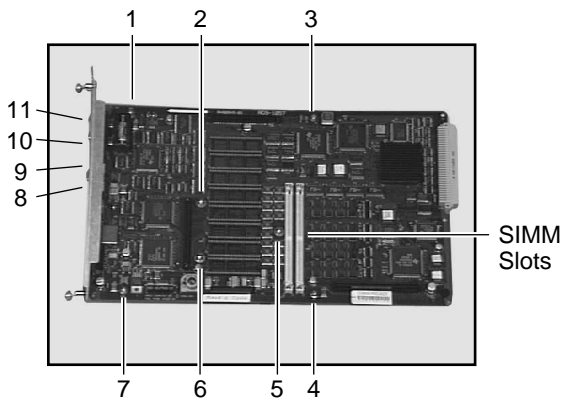


**Note:** If you are removing the I/O controller board to get to a deeper part, stop here. If you are replacing the board, proceed to step 2.

**I/O Controller Board** (page 2 of 2)

A replacement I/O controller board comes without SIMMs and without the I/O bracket. If you are replacing a board, remove the SIMMs from the old board and install them onto the new board. If the board you are replacing had v. 1.0 ROMs, copy the “LaserWriter Color 12/660” PPD into the customer’s Printer Description folder. For more information, see [“Driver Software” in the “CLW 12/660” chapter](#).

- 2
- To remove the I/O bracket, remove the seven screws that secure the board to the bracket plate and the four screws that secure the connectors to the bracket face panel. Separate the I/O board from the bracket.



## Air Filter (page 1 of 2)

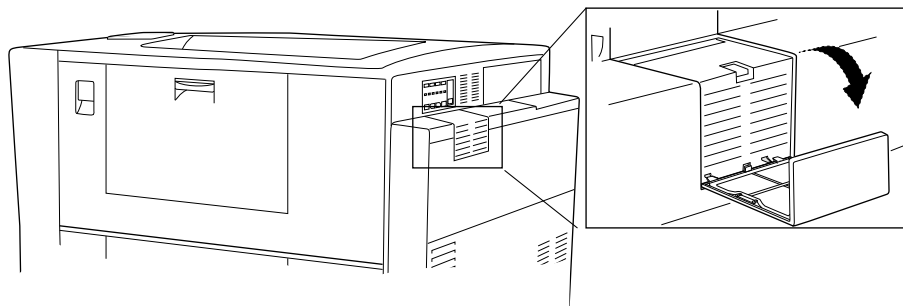
### First

No first steps are required.

**Note:** This part is available as P/N 922-1307. It also comes with the Fuser Replacement Kit (Finished Goods P/N M3867G/A for 110 V and M4234G/A for 220 V).

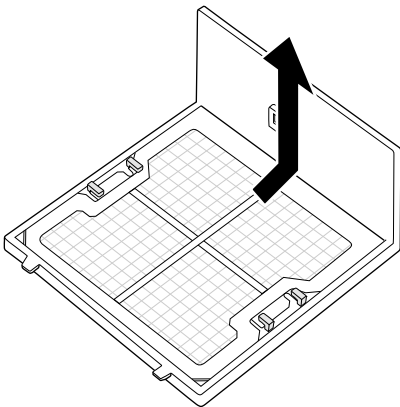
### Now

- 1 Press down slightly on the top of the filter cover, pull it outward, and remove it from the printer.



**Air Filter** (page 2 of 2)

- 2   Unlock and remove the air filter from the cover.



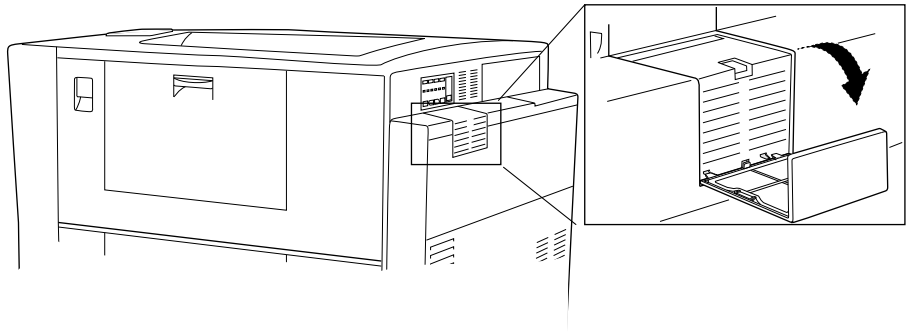
## Ozone Filter (page 1 of 2)

### First

No first steps are required.

### Now

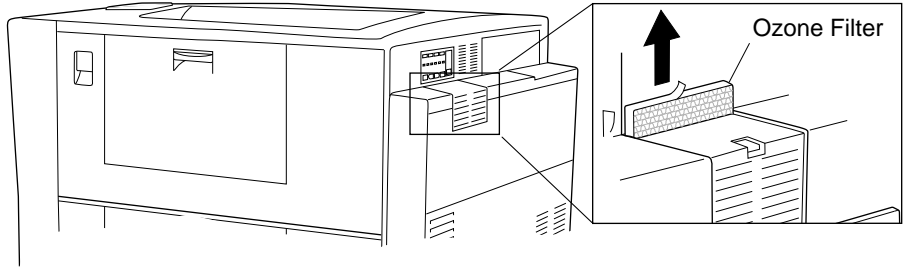
- 1 Press down slightly on the top of the filter cover, pull it outward, and remove it from the printer.





## Ozone Filter (page 2 of 2)

- 2 Grasp the tab on the ozone filter and slide the filter from its slot behind the fuser fan.



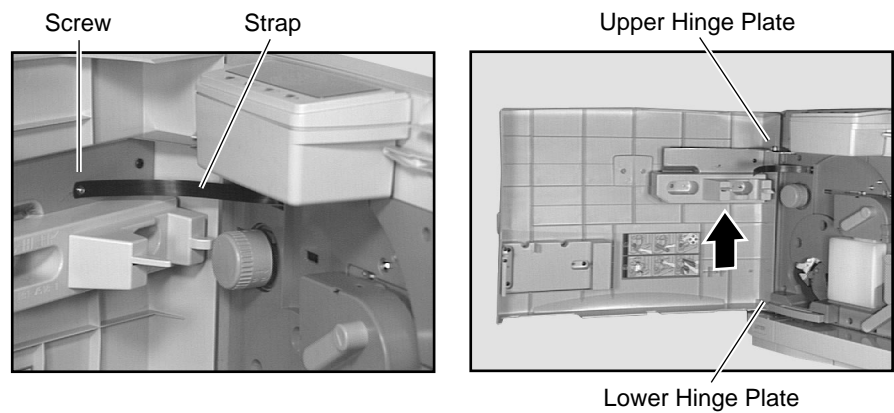
Front Door

First

No first steps are required.

Now

Open the front door and remove the brass-colored screw that holds the support strap to the door. Lift the front door upward off its hinge plates and remove it from the printer.



## Front Door Latch Adjustment

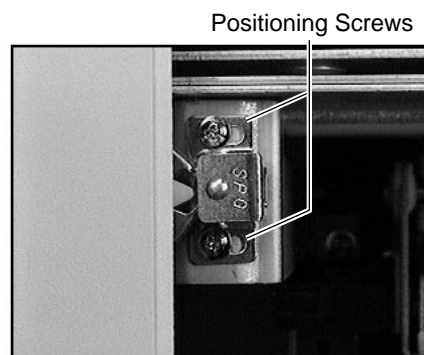
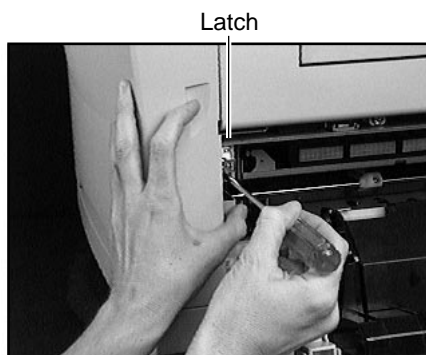
### First

Open the pickup block door.

After prolonged use or directly following shipment of the printer, the front door latch may get out of alignment just enough to prevent tight closure. If this has occurred, perform the following procedure:

### Now

Locate the positioning screws on the front door latch. With one hand, press the front door shut fully, slightly loosen and shift the two screws against the door catch, and then tighten the screws.

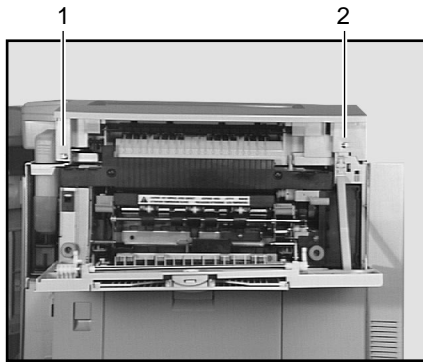


**Top Cover** (page 1 of 5)**First**

No first steps are required.

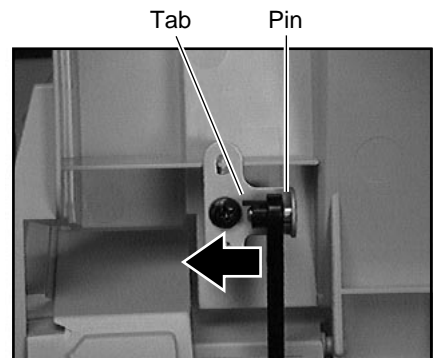
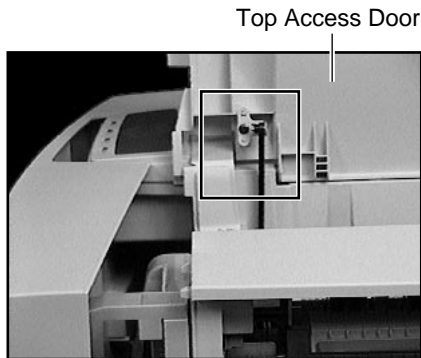
**Now**

- 1 Open the front door. Open the fuser access cover and remove the two brass-colored screws that secure the top cover to the printer chassis.



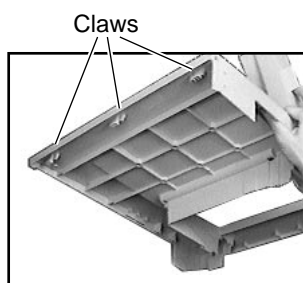
## Top Cover (page 2 of 5)

- 2 Open the top access door, release the small tab by gently pulling it upward, and slide the black arm off its pin.



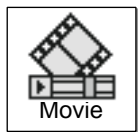
## Top Cover (page 3 of 5)

**Important:** There are three hidden claws at the left end of the top cover. In the step on the next page you will unseat these claws, raise the left end of the top cover, and remove the cover from the printer. Do not attempt to raise the fuser end of the cover first—you will damage these claws if you do.

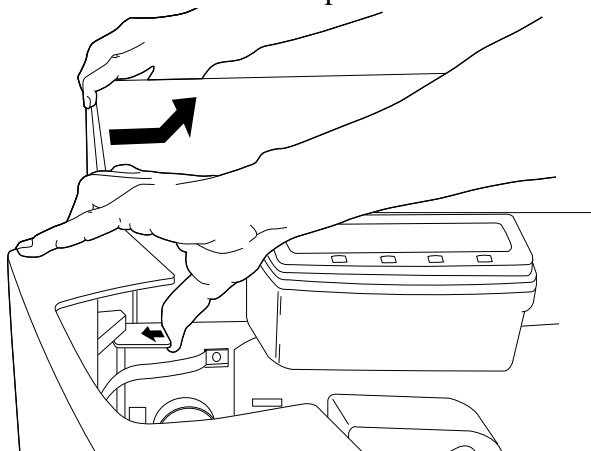


Claw Locator

## Top Cover (page 4 of 5)



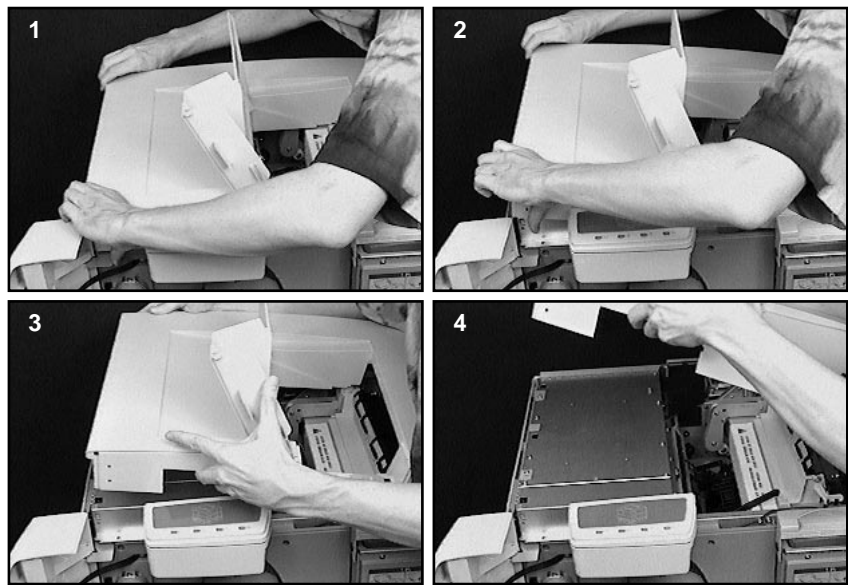
- 3 Reach across the top cover and hold your left thumb on the upper front door hinge plate and your right thumb on the I/O controller bracket screw. Pull firmly against the edge of the top cover to release the three claws and lift the cover from the printer.



**Replacement Note:** Apply even pressure along the left edge of the cover and make sure that the three claws are securely seated.

Top Cover (page 5 of 5)

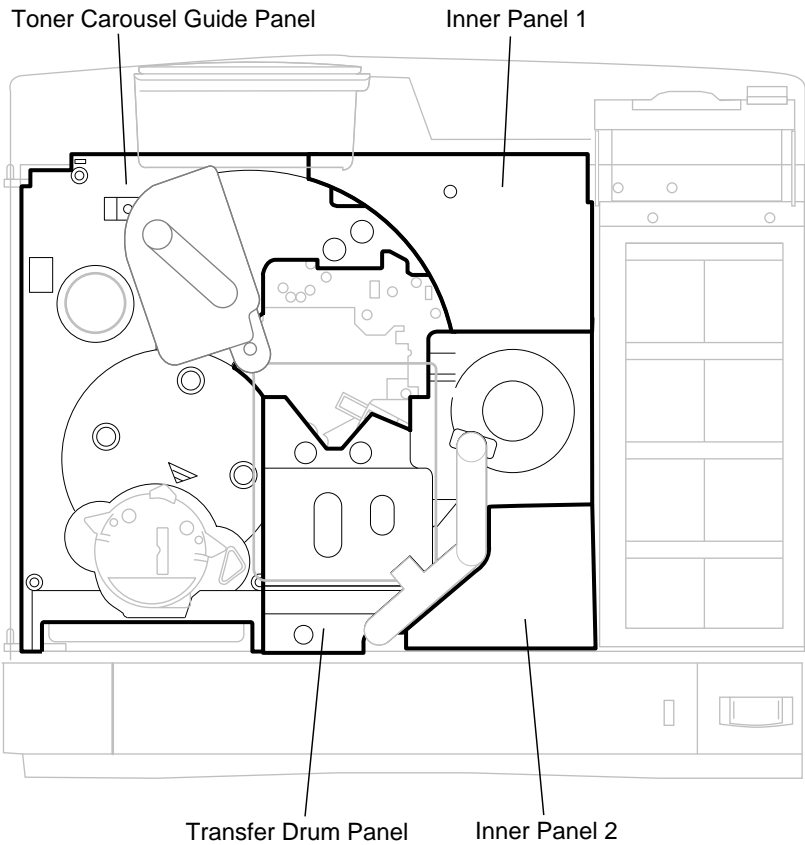
**Note:** The four frames below are from the movie on the previous page and are for the benefit of those who have printed out this topic.





About Inner Panels

**General**      The dark gray face of the front chassis wall is actually composed of four separate interlocking panels. Take-apart procedures for each follows this topic. The diagram below identifies each of the four.

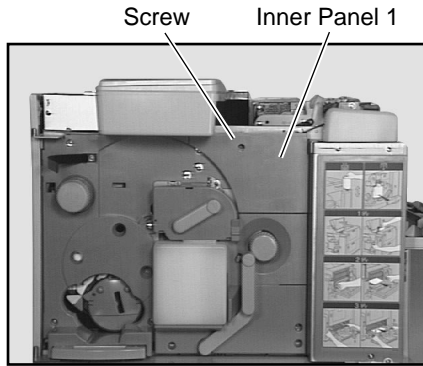


## Inner Panel 1

**First** Remove the top cover.

**Note:** Inner panel 1 is the plastic molding in the upper right portion of the front chassis wall.

**Now** Remove the brass-colored screw and remove inner panel 1 from the printer.



**Replacement Note:** Make sure not to pinch the cables.

## Inner Panel 2

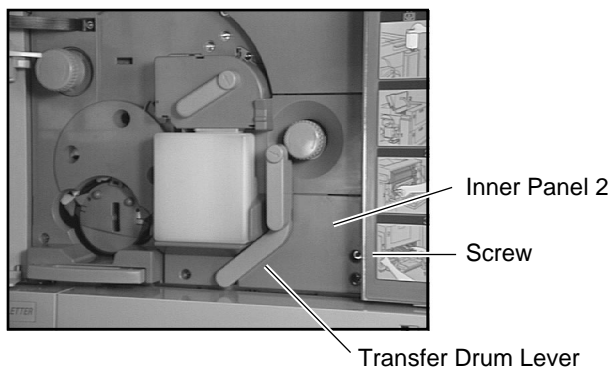
### First

No first steps are required.

**Note:** Inner panel 2 is the plastic molding in the lower right portion of the front chassis wall.

### Now

Remove the brass-colored screw (the second screw up from the bottom right corner). Insert a flat-blade screwdriver near the bottom of the transfer drum lever and pull inner panel 2 from the printer.



## Transfer Drum Panel

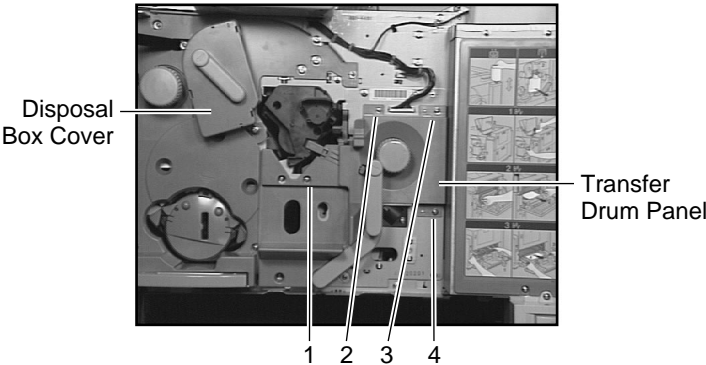
First

Remove the toner disposal box, top cover, inner panel 1, and inner panel 2.

**Note:** The transfer drum panel is the plastic molding on the front chassis wall that covers the end of the transfer drum.

Now

Raise the disposal box cover and remove the four brass-colored screws. Lower the transfer drum lever and remove the transfer drum panel from the printer.



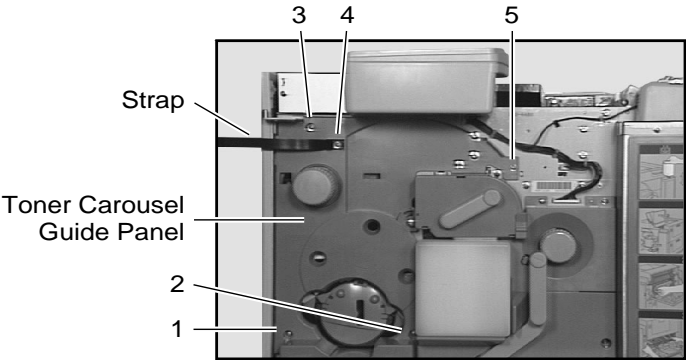
## Toner Carousel Guide Panel

**First**

Remove the top cover and inner panel 1.

**Now**

Remove the five brass-colored screws and the strap and remove the panel from the printer.



**Replacement Note:** Make sure that the panel nests over the two ears of the green stopper disk and does not pinch the cables behind the panel.

**Important:** This panel must be reinstalled before loading toner cartridges.

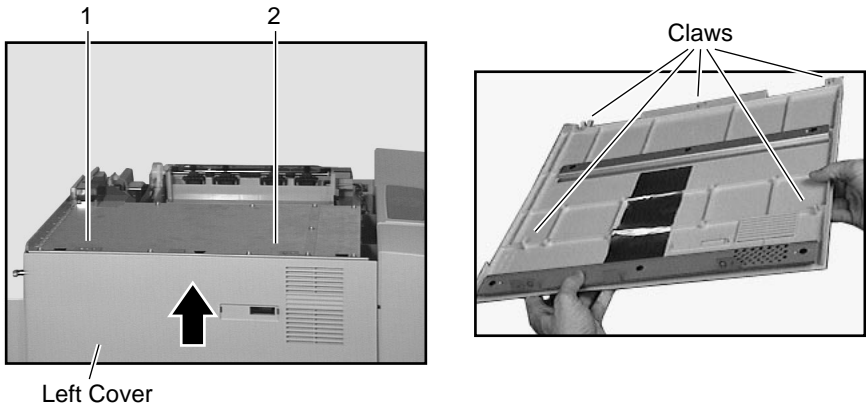
Left Cover

First

Remove the top cover.

Now

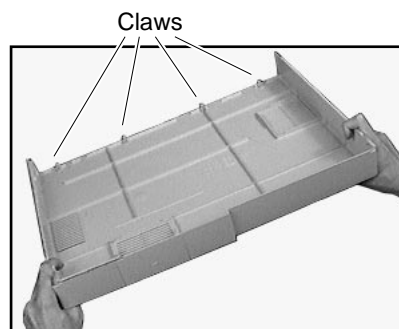
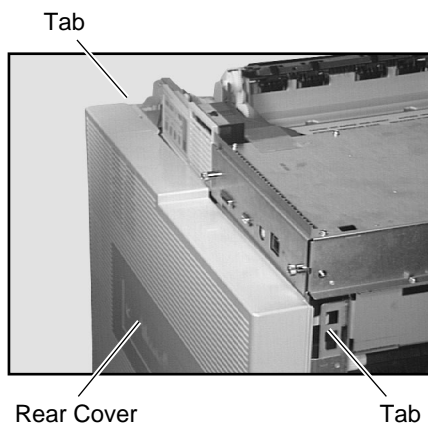
Remove the two silver-colored screws that secure the left cover frame to the chassis. Lift the left cover upward and remove it from the printer.



**Replacement Note:** Position the five claws into the cutouts in the chassis and lower the cover until it seats securely in place.

## Rear Cover

- First** Remove the top cover and left cover.
- Now** Release the two tabs at the upper corners of the rear cover and remove the cover from the printer.



**Replacement Note:** Position the four claws into the cutouts at the bottom of the chassis before installing the cover over the shield plate.

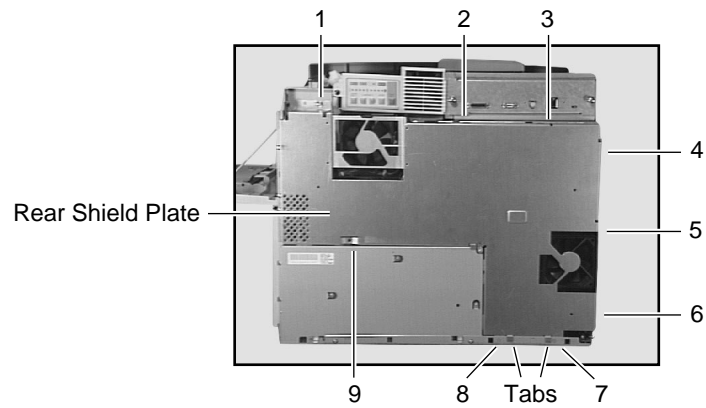
Rear Shield Plate

First

Remove the top cover, left cover, and rear cover.

Now

Remove the nine silver-colored screws that secure the rear shield plate to the chassis. Lift the shield plate and remove it from the printer.



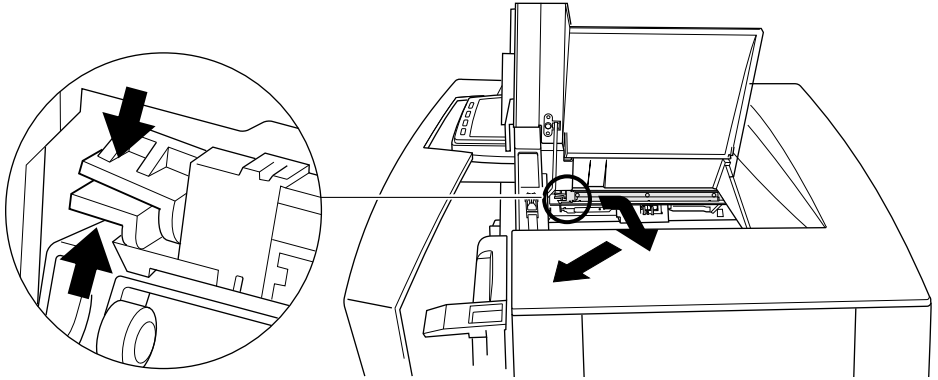
**Replacement Note:** The two metal tabs at the bottom of the shield plate nest over the edge of the chassis frame.



## Separation Discharge Assembly

**First** No first steps are required.

- Now**
- 1 Open the front door and the top cover.
  - 2 Release the tab, press the assembly slightly to the right, and remove the assembly from the printer.



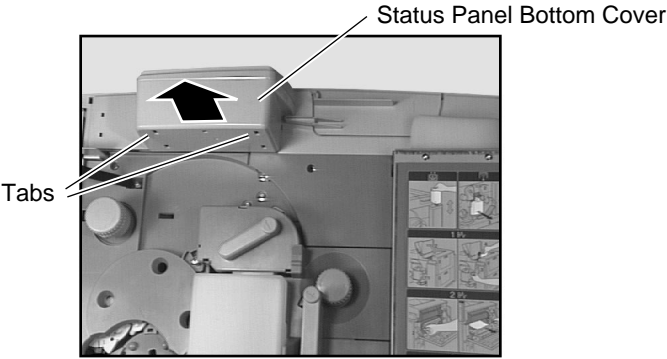
## Status Panel Bottom Cover

- First

No first steps are required.
- Now

Open the front door. Carefully release the two tabs and slide off the status panel bottom cover.
- Caution:

These tabs are very delicate—do not apply too much force.

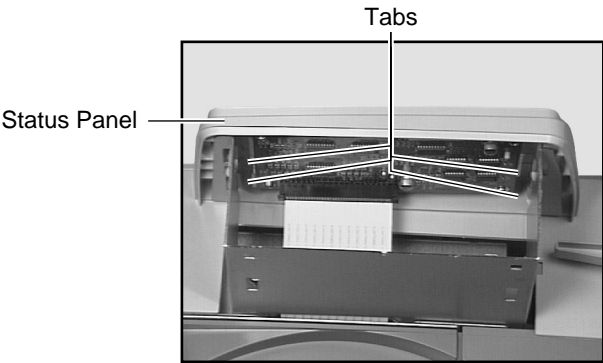


Status Panel

- First

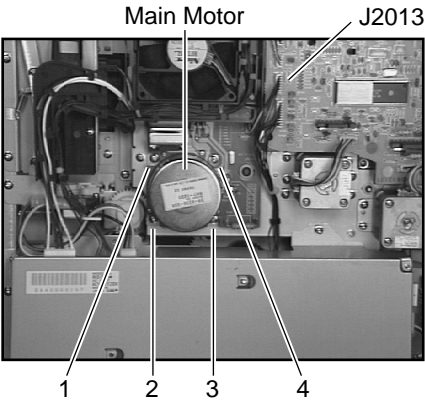
Remove the status panel bottom cover.
- Now

Carefully release the four flex-type tabs and disconnect the ribbon cable. Remove the status panel from the printer.



Main Motor

- First
- Remove top cover, left cover, rear cover, and rear shield plate.
- Now
- Disconnect J2013 from the mechanical controller board. Remove the four silver-colored screws and remove the motor from the printer.

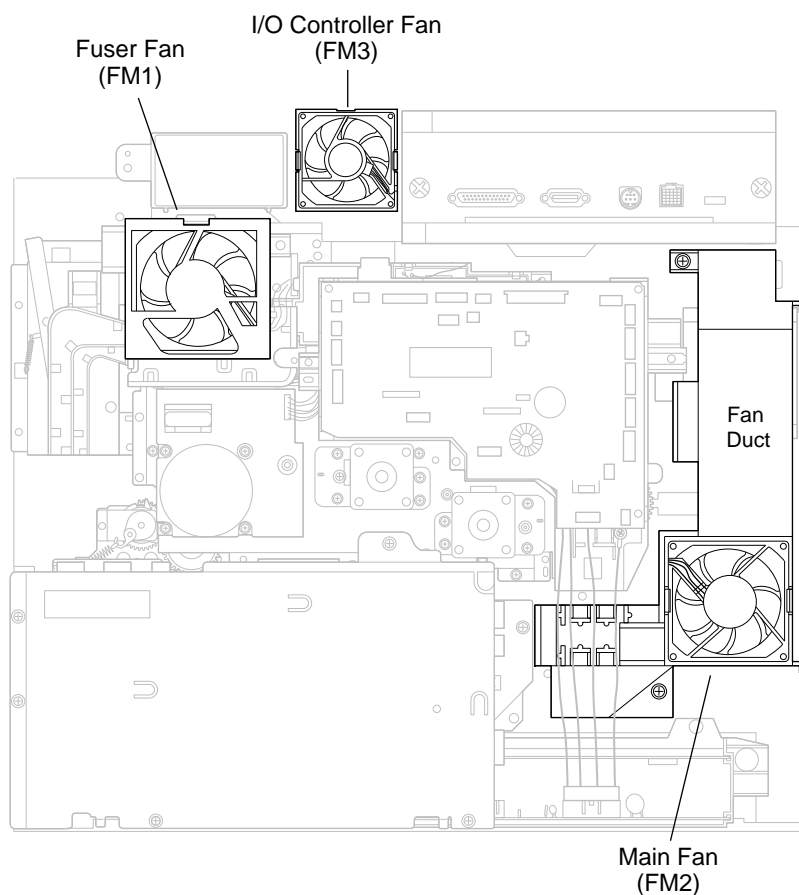


## About Fans

### General

There are three exhaust fans in the Color LaserWriter 12/600 PS. Take-apart procedures for each immediately follow this topic. The role of each fan is as follows:

- 1 Fuser fan (FM1): Exhausts air from behind the fuser assembly.
- 2 Main fan (FM2): Exhausts air from the area around the DC controller board and laser/scanner assembly.
- 3 I/O controller fan (FM3): Exhausts air from the I/O board housing.



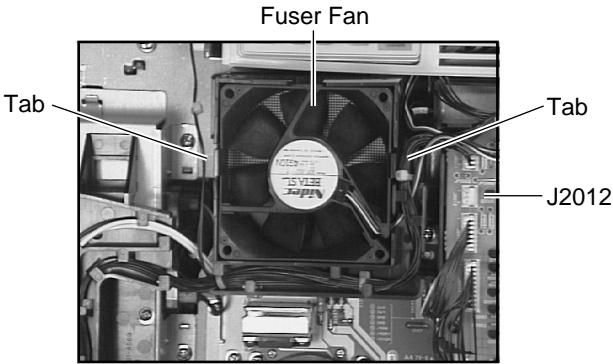
Fuser Fan (FM1) (page 1 of 2)

- First

Remove top cover, left cover, rear cover, and rear shield plate.
- Now

1

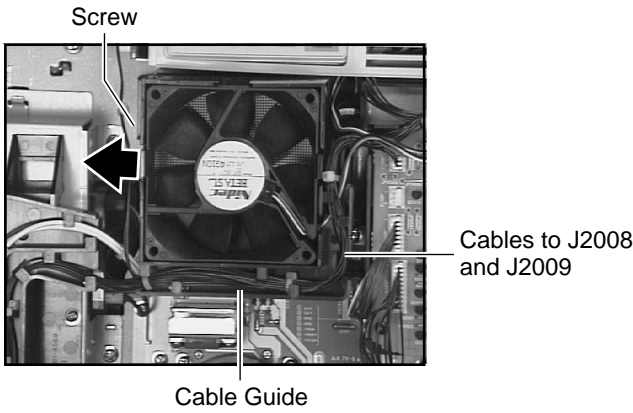
Disconnect J2012 from the mechanical controller board. If you are simply replacing the fan, release the two flex-type tabs and remove the fan from the printer. If you are removing the fan to get to a deeper part, proceed to step 2.



**Replacement Note:** Install the fan with the vendor label facing out.

Fuser Fan (FM1) (page 2 of 2)

- 2
- Disconnect J2008 and J2009 from the mechanical controller board and remove the cables from the cable guide in the fan duct. Remove the brass-colored screw, slide the fan and duct to the left to clear the hidden claw, pull the fan and duct from the printer.



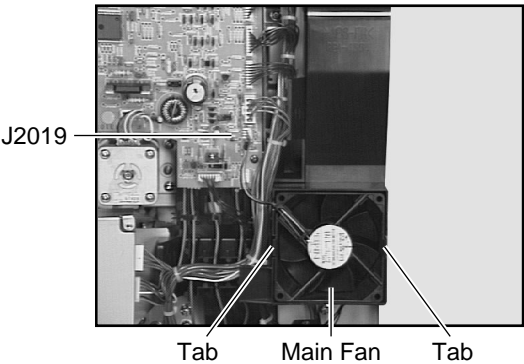
Main Fan (FM2) (page 1 of 3)

- First

Remove the top cover, left cover, rear cover, and rear shield plate.
- Now

1

If you are replacing a faulty fan, disconnect J2019 from the mechanical controller board, release the two tabs, and remove the fan. If you are removing the fan to get to a deeper part, begin at step 2.



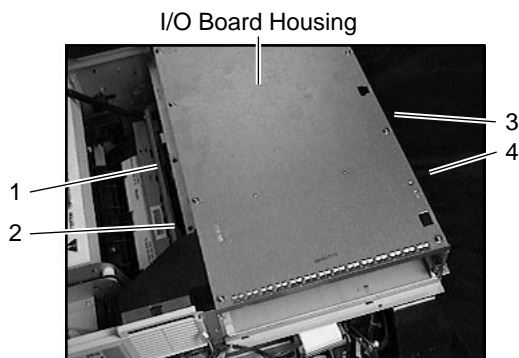
**Replacement Note:** Install the fan with the vendor label facing out.



## Main Fan (FM2) (page 2 of 3)

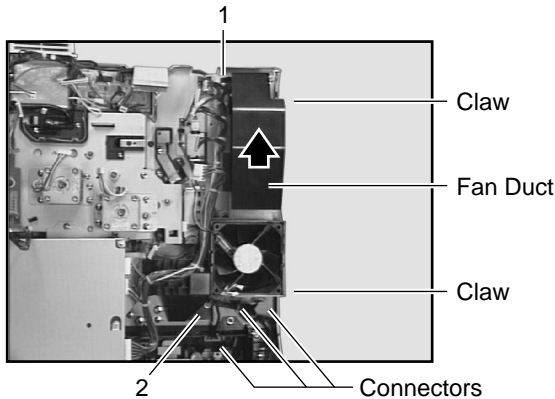
**Note:** For clearance purposes, you must loosen the I/O board housing so that you can perform step 3.

- 2 Remove the four rearmost screws that secure the I/O board housing to the chassis. Raise the I/O board housing slightly and hold it while you performing the next step.



**Main Fan (FM2)** (page 3 of 3)

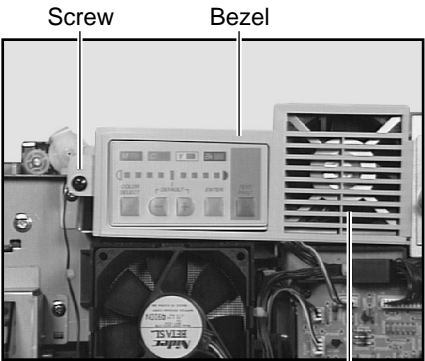
- 3 Remove the mechanical controller mount and board, remove the two brass-colored screws, and disconnect the three connectors below the duct. Grasp the fan duct, lift upward to release the two claws, and remove the fan and duct from the printer.



I/O Controller Fan (FM3) (page 1 of 2)

**First** Remove top cover, left cover, rear cover, and rear shield plate.

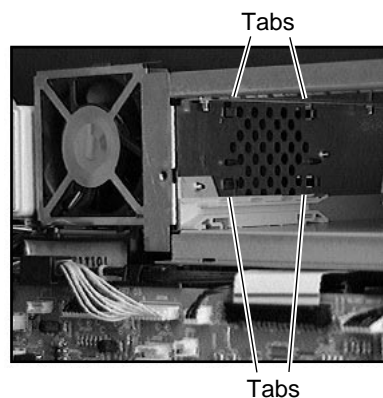
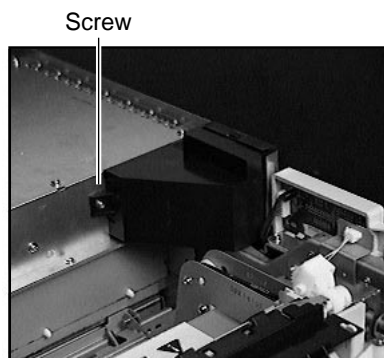
**Now** 1 Disconnect J2010 from the mechanical controller board. Remove the black screw and the plastic bezel.



I/O Controller Fan

## I/O Controller Fan (FM3) (page 2 of 2)

- 2 Remove the brass-colored screw and the four flex-type tabs that secure the fan duct to the I/O board housing. Remove the fan and duct from the printer, then remove the fan from the grounding plate and duct.

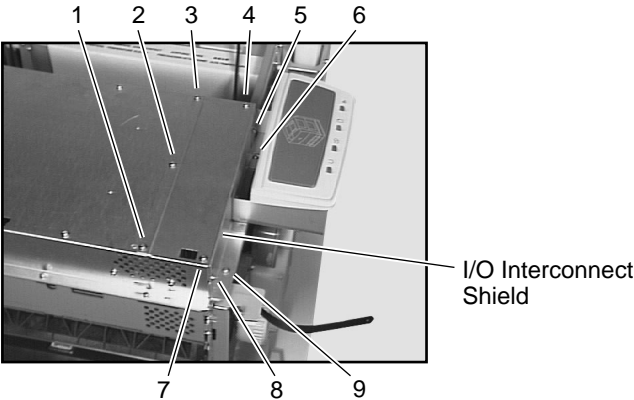


**Replacement Note:** Install the fan with the vendor label facing out.

I/O Interconnect Shield (page 1 of 2)

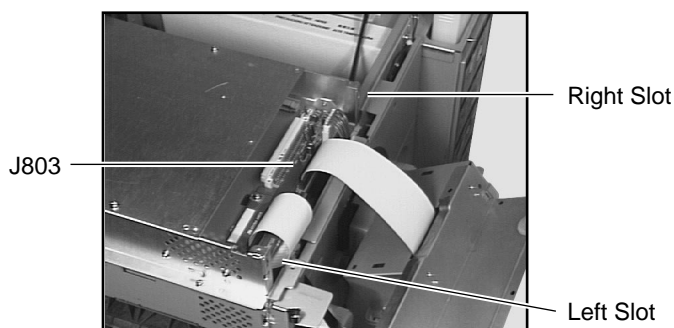
**First** Remove the front door, top cover, and status panel bottom cover.

**Now** 1 Remove the nine silver-colored screws that secure the I/O interconnect shield to the chassis.



## I/O Interconnect Shield (page 2 of 2)

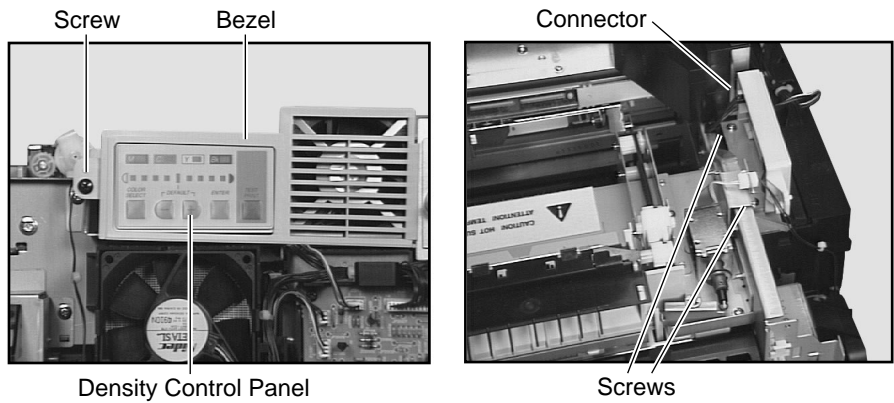
- 2 Lift the shield and status panel housing and disconnect J803 on the I/O interconnect board. Remove the shield and housing from the printer.



**Replacement Note:** Two small claws on the I/O interconnect shield mate into slots in the chassis. If the left slot is not rectangular, you may need to flatten the left claw prior to reinstallation to assure a tight fit between shield and chassis. Note that there is a ribbon cable grounding pad beneath the flange, so you will not get a familiar metal-to-metal fit.

Density Control Panel

- First
- Remove top cover, left cover, rear cover, and rear shield plate.
- Now
- Remove the black screw and the plastic bezel. Remove the two silver-colored screws, disconnect connector J1 on the back of the density control panel, and remove the panel from the printer.



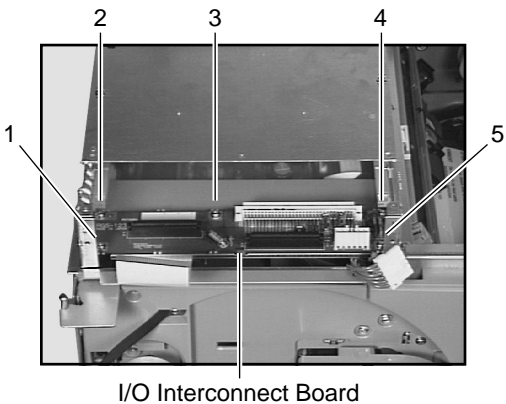
## I/O Interconnect Board

First

Remove I/O controller board, front door, top cover, status panel bottom cover, and I/O interconnect shield.

Now

Disconnect the connectors from the I/O interconnect board. Remove the five silver-colored screws and remove the interconnect board from the printer.



I/O Interconnect Board



## DC Controller Board (page 1 of 5)

### First

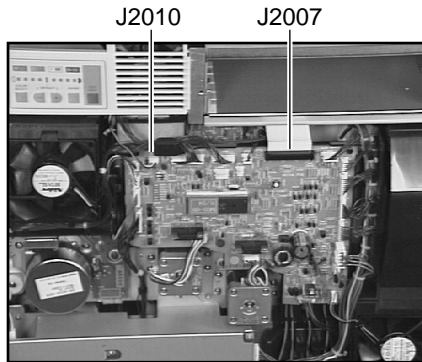
Remove the I/O controller board, front door, top cover, left cover, rear cover, rear shield plate, status panel bottom cover, and I/O interconnect shield.

**Important:** The DC controller board stores important information about consumables and other customer-specific parameters. If you are replacing the DC controller board, you must first download these parameters from the old board so that you can upload them to the replacement board. For more information, see “Diagnostic Utility” in Chapter 2.

## DC Controller Board (page 2 of 5)

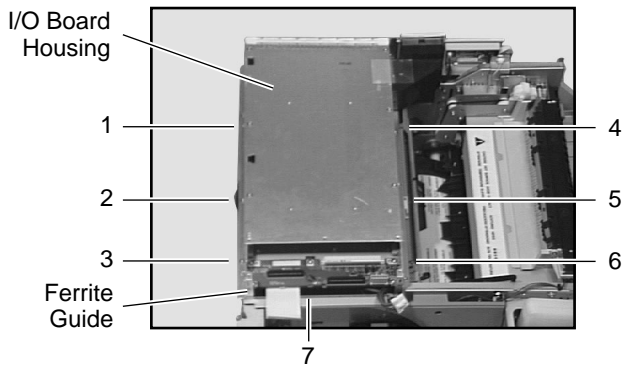
- Now**
- 1 Disconnect connectors J2007 and J2010 from the mechanical controller board.

**Note:** J2010 is the wide ribbon cable at the top of the mechanical controller board.



DC Controller Board (page 3 of 5)

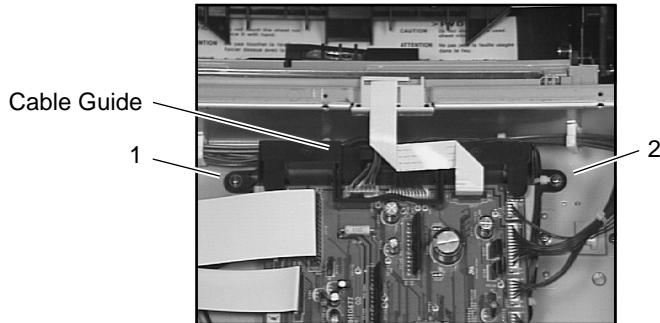
- 2 Remove the seven silver-colored screws that secure the I/O board housing to the chassis. Disconnect connectors J802 and J804 from the I/O interconnect board and remove the cable from the cable clamp.



**Replacement Note:** When replacing the I/O board housing, make sure to thread the ribbon cable through the ferrite guide.

## DC Controller Board (page 4 of 5)

- 3 Pull the fan cable under the density control panel bezel and lift the I/O board housing from the printer (not shown in photo). Remove the two brass-colored screws that secure the black cable guide to the chassis. Disconnect connectors J101, J102, and J103 at the cable guide and remove the cable guide from the printer.

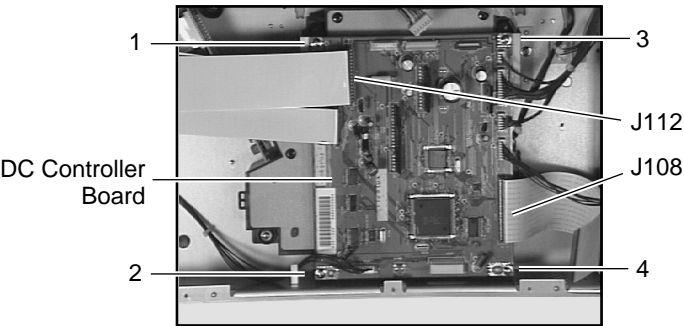


**Replacement Note:** Make sure to seat the cable guide firmly into the two cutouts in the chassis.

DC Controller Board (page 5 of 5)

- 4 Remove all the remaining connectors and the four silver-colored screws, and remove the DC controller board from the printer.

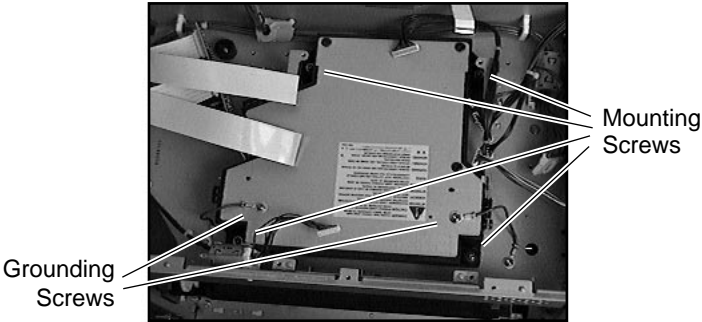
**Note:** J108 and J112 have a clampless socket-style fitting. If you are removing the board only to get to the laser scanner assembly, do not disconnect these two connectors. If you are replacing the board, grasp each edge of the cable and carefully pull straight up to remove the cable. Reverse the action to reinstall it. The cable at J112 is available as P/N 922-1344. The cable at J108 is available as P/N 922-1345.



Laser/Scanner Assembly

**First** Remove the I/O controller board, front door, top cover, left cover, rear cover, rear shield plate, status panel bottom cover, I/O interconnect shield, and DC controller board.

**Now** Remove the two silver-colored grounding screws and four brass-colored mounting screws that secure the laser/scanner assembly to the chassis. Remove the assembly from the printer.



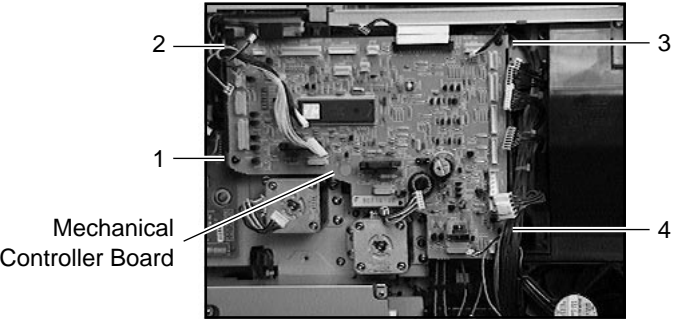
## Mechanical Controller Board

- First

Remove the top cover, left cover, rear cover, and rear shield plate.
- Note:

Perform this procedure only if you are replacing a board. If you are disassembling the printer to get to a deeper part, see the “Mechanical Controller Mount and Board” topic.
- Now

Remove the four black screws and all the connectors going into the board, and remove the board from the printer.



**Replacement Note:** Connectors J2018, J2020, and J2021 are empty.

## Mechanical Controller Mount and Board (page 1 of 3)

**First** Remove the top cover, left cover, rear cover, and rear shield plate. For better clearance you can also remove the main fan.

**Note:** Perform this procedure only if you need to get to a part deeper in the printer. If you simply want to replace the mechanical controller board, see the “Mechanical Controller Board” topic.

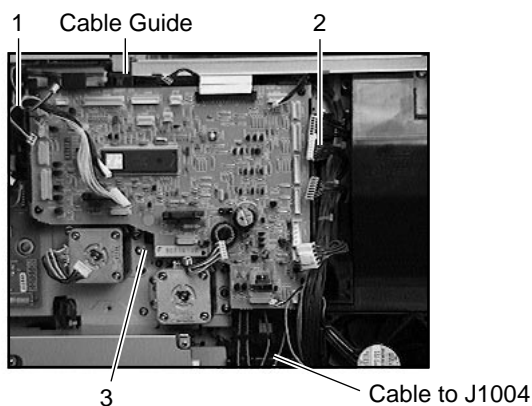
**Now** 1 Remove all the connectors going into the mechanical controller board.

**Replacement Note:** J2018, J2020, and J2021 are empty.



## Mechanical Controller Mount and Board (page 2 of 3)

- 2 Remove the two silver-colored screws at the left and right side of the board, and the one brass-colored screw below the board. Remove the cables from the cable guide at the top of the board. Disconnect the large connector going into J1004 on the high-voltage power supply.

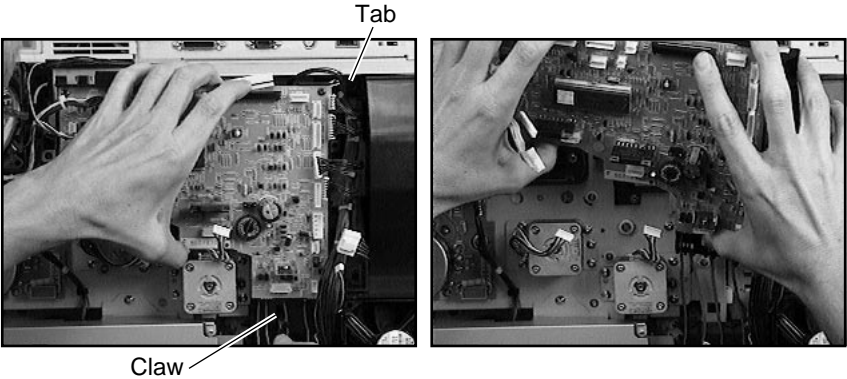


**Replacement Note:** Make sure that you install the three screws tightly in their correct locations.

Mechanical Controller Mount and Board (page 3 of 3)



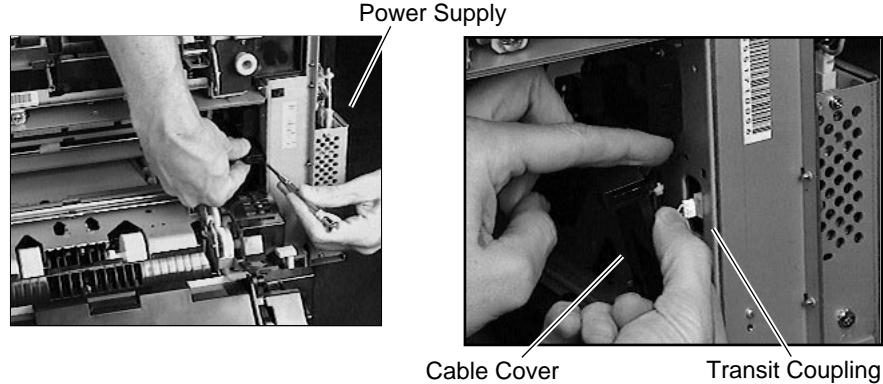
- 3 Using a flat-blade screwdriver, press upward on the claw that hooks into the chassis below connector J2017. Lift the mount slightly to free the tab at the upper right, and remove the mount and board from the printer, using an outward rolling motion.



Power Supply (page 1 of 2)

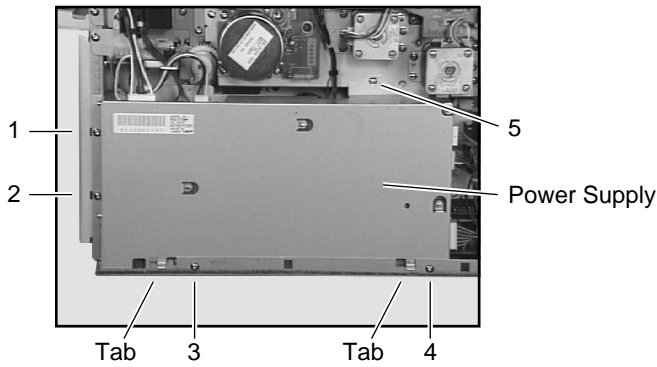
**First** Remove the top cover, left cover, rear cover, and rear shield plate. Slide the paper pickup block outward as described in step 1 of the “Paper Pickup Block Removal” topic.

**Now** 1 Release the tab that secures the black power switch cable cover to the pickup block side of the chassis wall, (the lower of the two cable covers in that area). Pull the cable cover away from the chassis and disconnect the power switch connector from the transit coupling.



Power Supply (page 2 of 2)

- 2 Remove the five silver-colored screws and the six connectors along the edges of the power supply and remove the power supply from the printer.



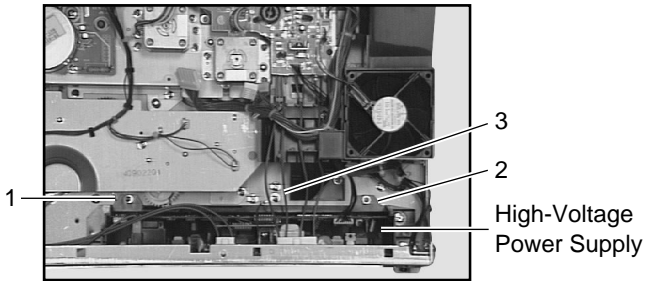
**Replacement Note:** The two metal tabs at the bottom of the power supply nest over the edge of the chassis frame.

## High-Voltage Power Supply

- First

Remove the paper cassette, top cover, left cover, rear cover, rear shield plate, and power supply. Leave the paper pickup block in its out position.
- Now

Remove the two brass-colored screws that secure the high-voltage power supply to the chassis. Remove the silver-colored grounding screw. Disconnect the four connectors and pull the high-voltage power supply out of the printer.



**Replacement Note:** You can guide the rear edge of the high-voltage power supply from the inside of the chassis.

## About Solenoids

### General

There are nine solenoids in the Color LaserWriter 12/600 PS and one in the optional sheet feeder. Five of these are available only as a part of larger assemblies (see “Solenoids/Clutches” in Chapter 4). The five solenoids listed below are available separately.

Cleaning belt drive solenoid SL3

Solenoid SL3 is located in the upper rear of the printer to the right of the paper delivery assembly. See the “Cleaning Belt Drive Solenoid” topic that follows for take-apart instructions.

Attraction roller press solenoid SL6

Transfer drum press solenoid SL7

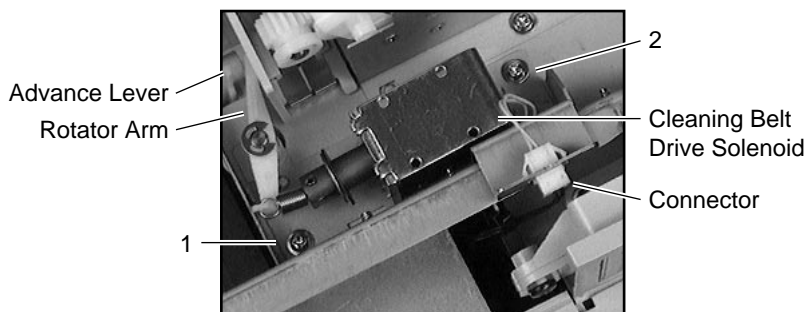
Transfer drum cleaner press solenoid SL8

Discharge roller press solenoid SL9

The last four solenoids are mounted together on a plate located above the power supply. You must first remove this solenoid assembly from the printer before you can remove any of the individual solenoids. See the “Solenoid Assembly” topic for take-apart instructions.

## Cleaning Belt Drive Solenoid

- First** Remove the top cover.
- Now**
- 1 Remove the two silver-colored screws and disconnect the connector on the rear face of the transit coupling. Lift the cleaning belt drive solenoid from the printer.



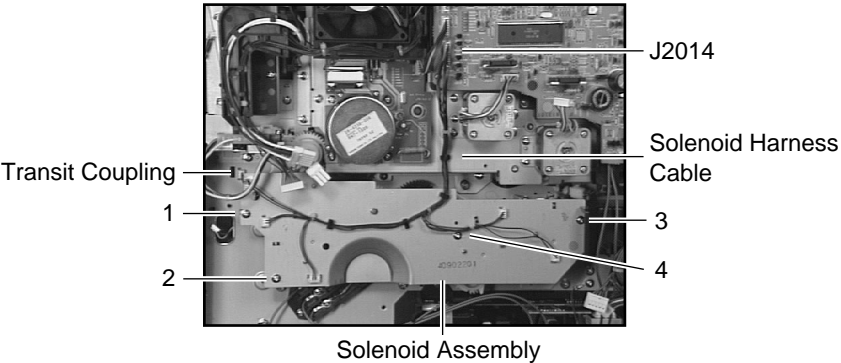
### Replacement Notes:

- 1 Make the connection at the transit coupling before placing the solenoid.
- 2 Make sure to position the left end of the white rotator arm behind the cleaning belt advance lever.

Solenoid Assembly (page 1 of 2)

**First** Remove the top cover, left cover, rear cover, rear shield plate, and power supply. Leave the paper pickup block in its out position.

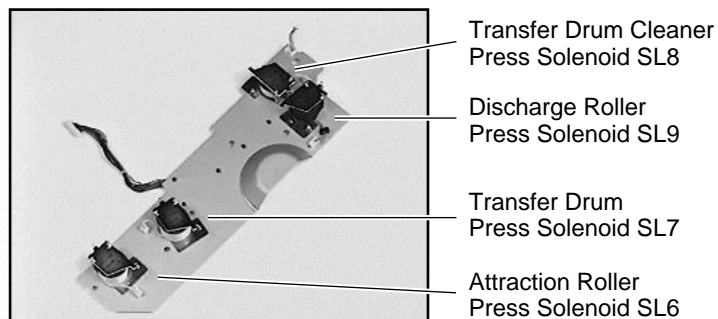
**Now** 1 Disconnect the solenoid harness cable from J2014 on the mechanical controller board. Remove the cable from the cable clamp on the printer chassis. Disconnect the transfer drum cleaner connector from the transit coupling near the left end of the assembly. Remove the four silver-colored screws and remove the solenoid assembly from the printer.





## Solenoid Assembly (page 2 of 2)

- 2 If you need to replace one of the solenoids, remove the screw and lift the solenoid from the support plate.

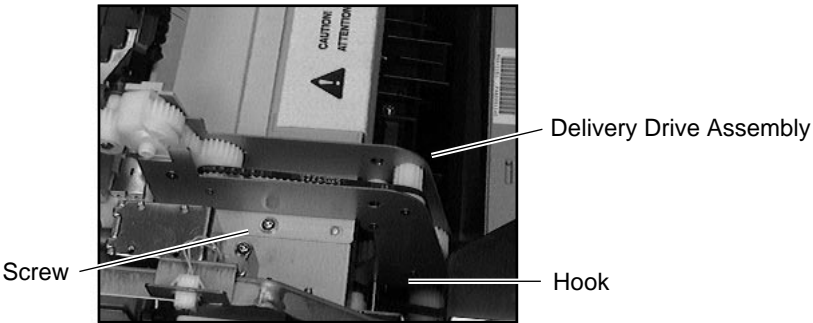


## Delivery Drive Assembly

- First

Remove the top cover.
- Now

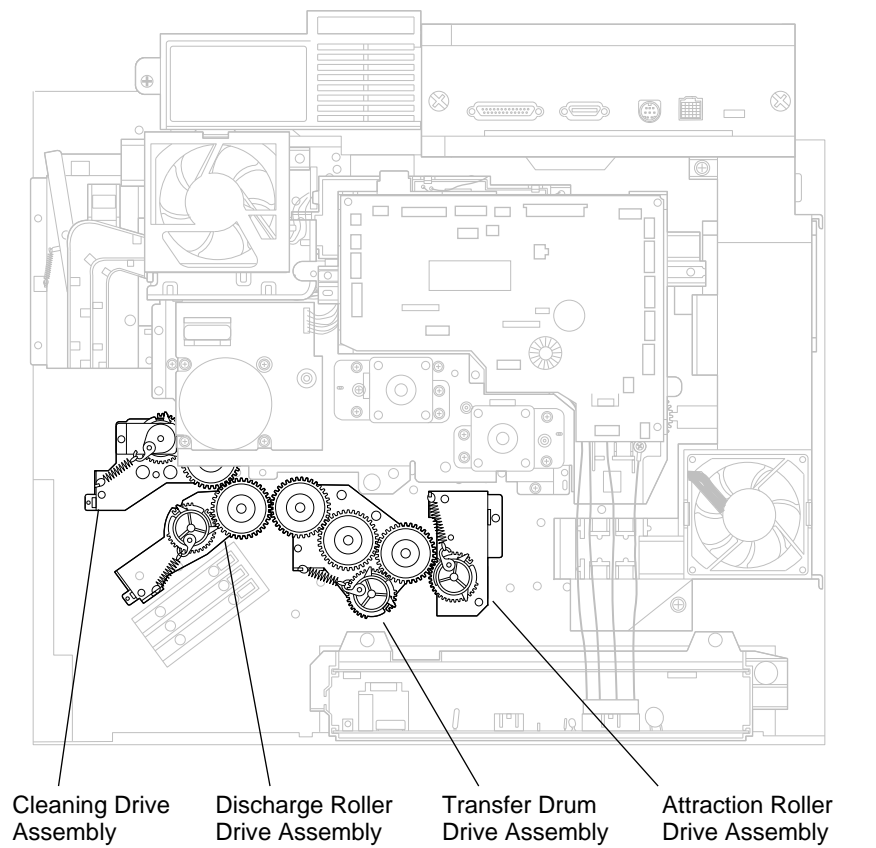
Remove the silver-colored screw that secures the delivery drive assembly to the printer. Swing the assembly back, unhook it from the metal shaft, and remove the assembly from the printer.



## About Transfer Drum Peripherals

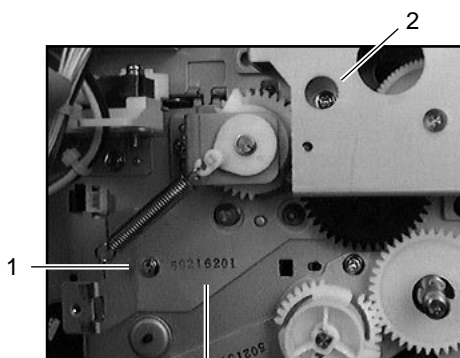
### General

The four assemblies below transfer mechanical drive to the transfer drum and its peripherals. Take-apart procedures for each directly follow this topic. Refer to Chapter 1 for full information on the functions of these four assemblies.



## Cleaning Drive Assembly

- First** Remove the top cover, left cover, rear cover, rear shield plate, power supply, solenoid assembly, and main motor. Leave the paper pickup block in its out position.
- Now** Remove the two silver-colored screws and remove the cleaning drive assembly from the printer.

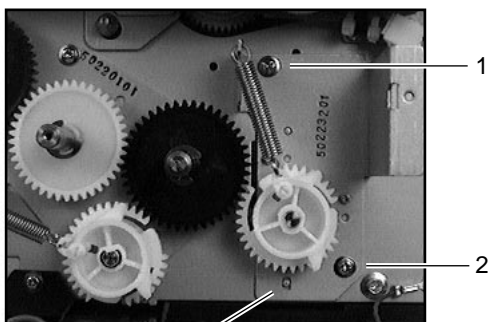


Cleaning Drive Assembly

## Attraction Roller Drive Assembly

**First** Remove the top cover, left cover, rear cover, rear shield plate, power supply, and solenoid assembly. Leave the paper pickup block in its out position.

**Now** Remove the two silver-colored screws and remove the attraction roller drive assembly from the printer.

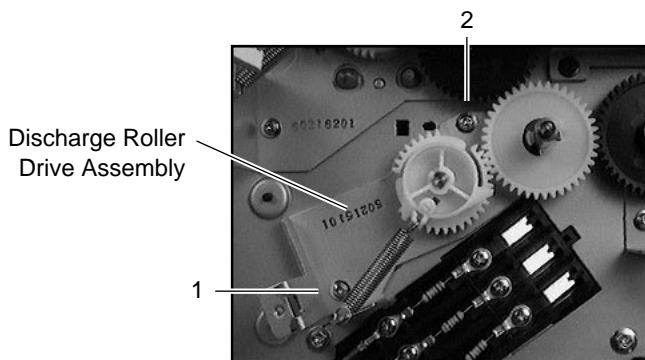


Attraction Roller Drive Assembly

## Discharge Roller Drive Assembly

**First** Remove the top cover, left cover, rear cover, rear shield plate, power supply, and solenoid assembly. Leave the paper pickup block in its out position.

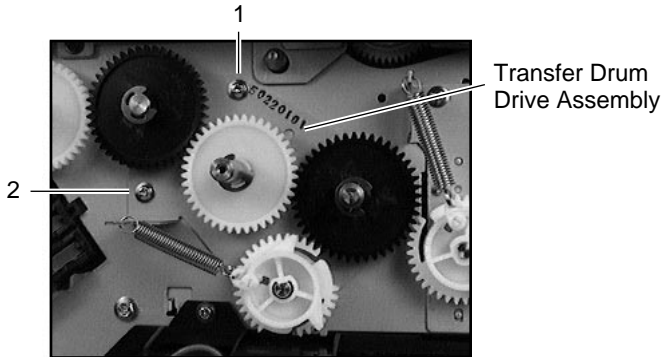
**Now** Remove the two silver-colored screws and pull the discharge roller drive assembly out of the printer.



## Transfer Drum Drive Assembly

**First** Remove the top cover, left cover, rear cover, rear shield plate, power supply, and solenoid assembly. Lower the transfer drum lever. Leave the paper pickup block in its out position.

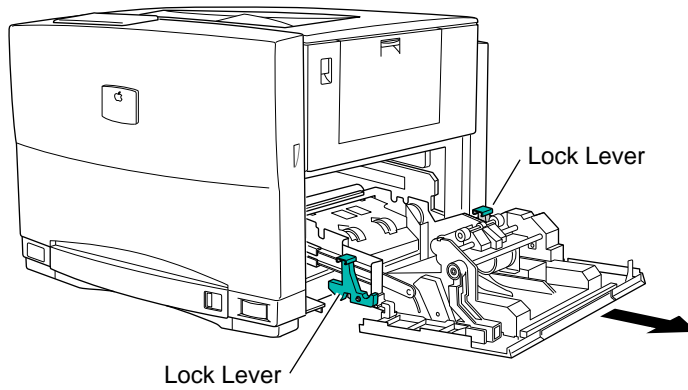
**Now** Remove the two silver-colored screws and remove the transfer drum drive assembly from the printer.



**Replacement Note:** Make sure that the shaft is properly seated in the white bushing at the front side of the printer.

## Transfer Drum Cleaning Assembly (page 1 of 4)

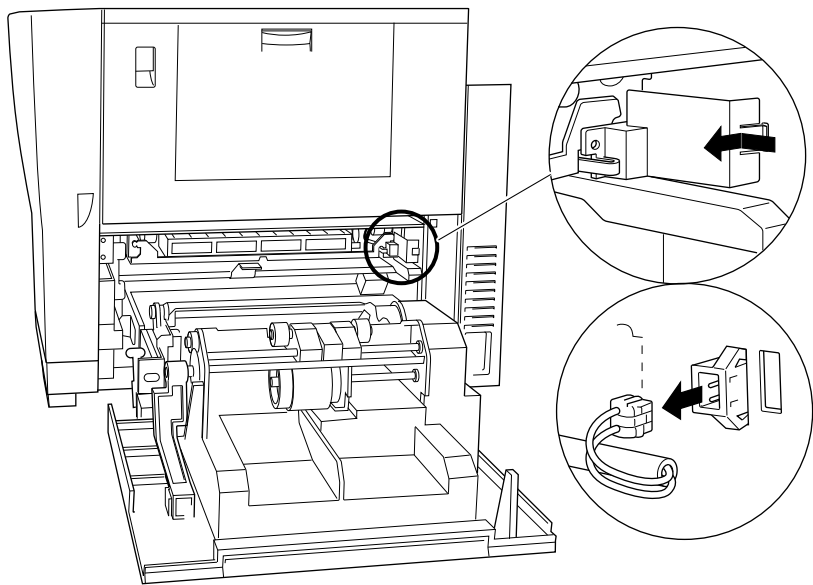
- First** No first steps are required.
- Now** 1 Open the pickup block cover. Release the green lock levers at each side of the pickup block and slide the block out.





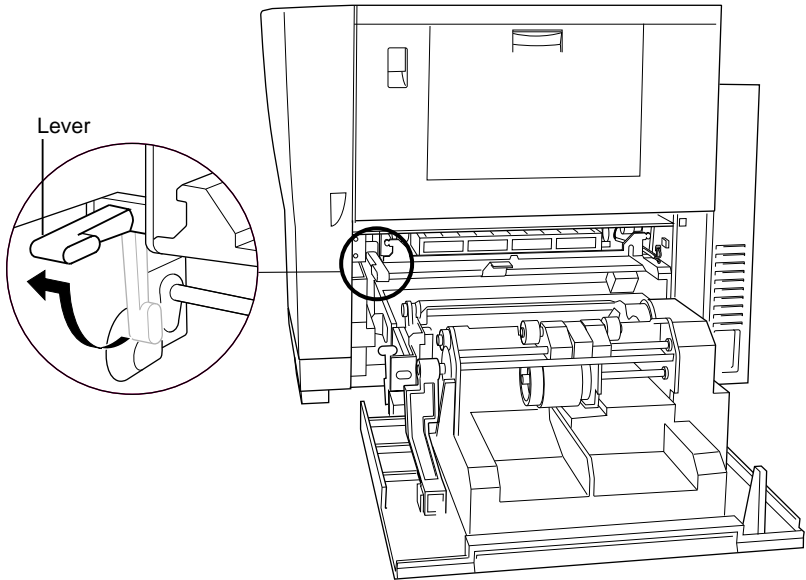
Transfer Drum Cleaning Assembly (page 2 of 4)

- 2 Remove the connector cover at the right end of the assembly and unplug the connector.



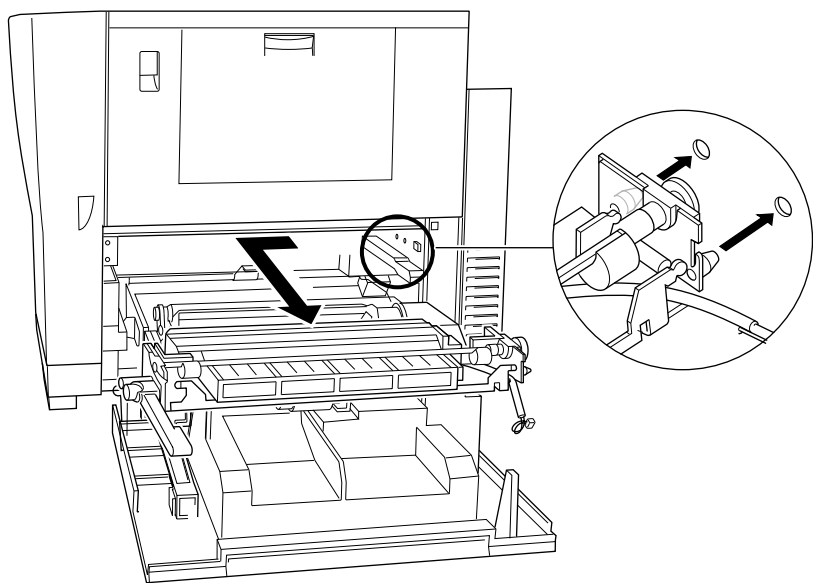
## Transfer Drum Cleaning Assembly (page 3 of 4)

- 3 Unlock the lock lever at the left end of the assembly.



Transfer Drum Cleaning Assembly (page 4 of 4)

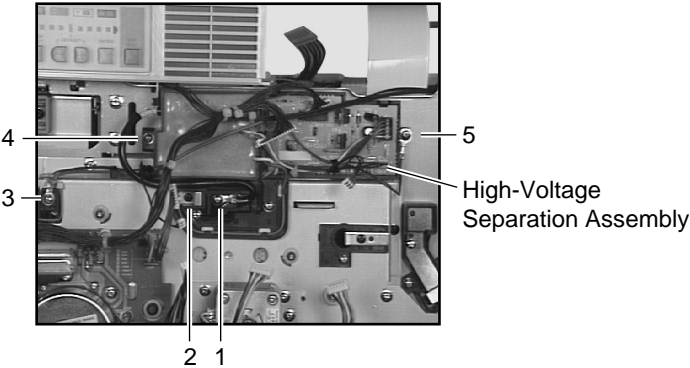
- 4 Slide the assembly to the left and pull it out of the printer.



High-Voltage Separation Assembly (page 1 of 3)

**First** Remove the I/O controller board, top cover, left cover, rear cover, rear shield plate, fuser fan, and mechanical controller mount and board.

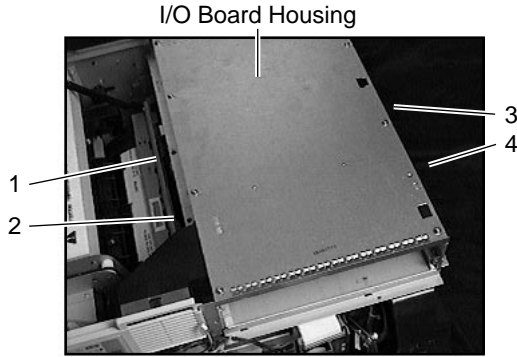
**Now** 1 Remove the three brass-colored terminal-contact screws, the brass-colored screw that secures the assembly to the chassis, and the silver-colored grounding screw. Remove the contact cables from their guides and clamps.



## High-Voltage Separation Assembly (page 2 of 3)

**Note:** For clearance purposes, you must loosen the I/O board housing so that you can perform step 3.

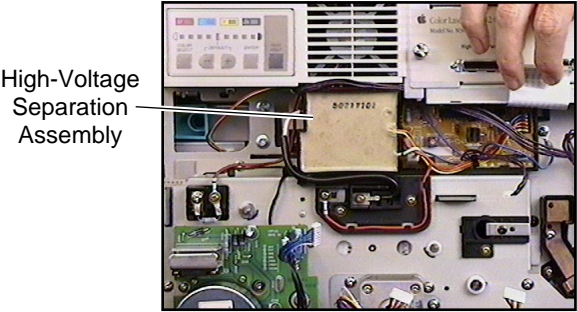
- 2 Remove the four rearmost silver-colored screws that secure the I/O board housing to the chassis, raise the housing slightly, and hold it.



- 3 Grasp the high-voltage separation assembly and shift it firmly to the left to release the claw. Remove the assembly from the printer.

High-Voltage Separation Assembly (page 3 of 3)

**Replacement Note:** Make sure to place all of the cabling securely into the proper cable guides.

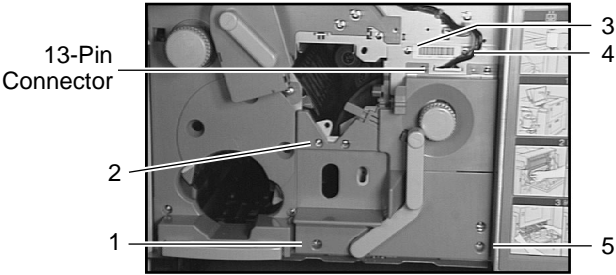


Transfer Drum Assembly (page 1 of 2)

**First** Remove the toner disposal box, photoconductor cartridge, toner cartridges, inner panel 1, top cover, and pickup block. Raise the separation discharge assembly.

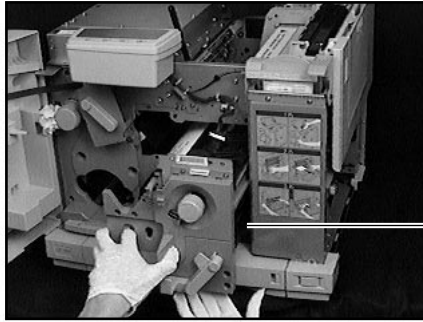
**Caution:** Use cotton gloves when working with the transfer drum. Do not touch the surface of the drum with your hands. If the surface gets soiled, use only lint-free paper or cloth to clean it.

**Now** 1 Disconnect the 13-pin connector from the end plate of the transfer drum assembly and remove the five silver-colored screws.



## Transfer Drum Assembly (page 2 of 2)

- 2 Lower the transfer drum lever. Grasp the rounded opening in the transfer drum end panel and slide the assembly halfway out. Place your other hand underneath the assembly and finish sliding it from the printer. Do not scrape the surface of the drum against the chassis.



Transfer Drum  
Assembly

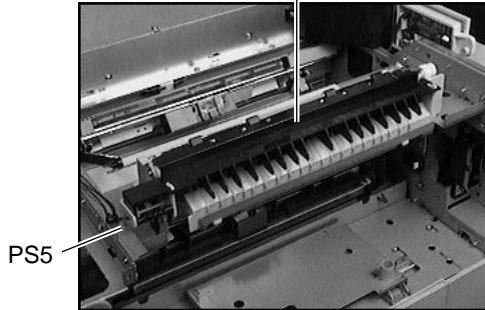
**Replacement Note:** The discharge roller on the transfer drum has a metal plate extension that is designed to rest against the white discharge roller drive cam. Make sure that this plate extension is in contact with the cam and that the extension is above the metal shaft.



## Paper Delivery Assembly (page 1 of 2)

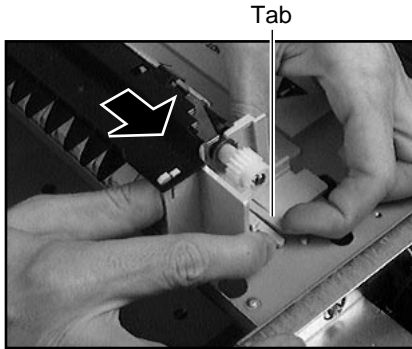
- First** Remove the top cover, fuser oil bottle, fuser assembly, cleaning belt drive solenoid, and delivery drive assembly.
- Now** 1 Disconnect the connector at cleaning belt sensor PS5 at the left end of the paper delivery assembly.

Paper Delivery Assembly



## Paper Delivery Assembly (page 2 of 2)

- 2 Release the flex tab and shift the assembly to the right to unhook the claws. Remove the assembly from the printer.



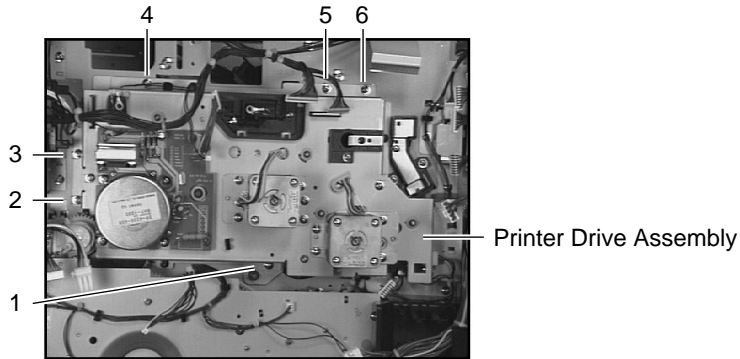
Printer Drive Assembly (page 1 of 2)

- First

Remove the toner disposal box, photoconductor cartridge, toner cartridges, I/O controller board, fuser assembly, top cover, inner panel 1, delivery drive assembly, left cover, rear cover, rear shield plate, fuser fan, mechanical controller mount and board, high-voltage separation assembly, paper pickup block, and transfer drum assembly.
- Now

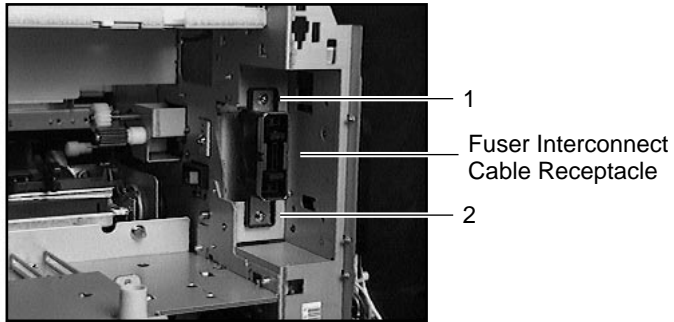
1

Remove the six long silver-colored screws that secure the printer drive assembly to the printer.



## Printer Drive Assembly (page 2 of 2)

- 2 For clearance purposes, remove the two silver-colored screws that secure the receptacle of the fuser interconnect cable to the chassis.



- 3 Carefully remove the printer drive assembly from the printer.

**Replacement Note:** Press the assembly straight inward while using a slight side-to-side rocking motion. Give special attention to meshing correctly the gears at the right side of the drive assembly.

## Toner Sensor (Emitter)

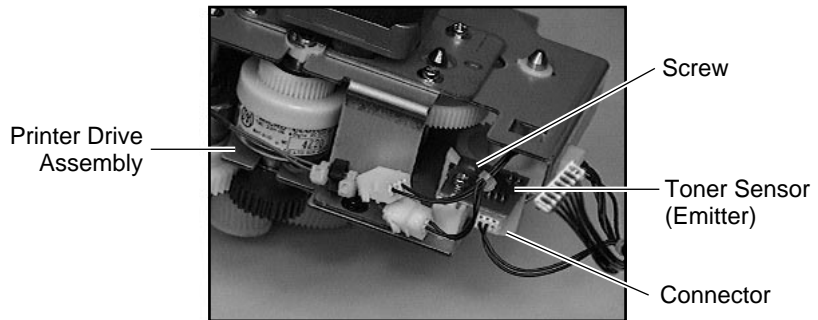
### First

Remove the printer drive assembly (see previous topic).

The toner sensor emitter is a part of printer drive assembly P/N 922-1334. The circuit board portion of the emitter is also available separately as P/N 922-1558.

### Now

Remove the connector and the brass-colored screw and remove the toner sensor emitter from the printer drive assembly.



**Important:** Do not touch the sensor with your hands. If it gets soiled, clean it with a lint-free paper or cloth.

**Toner Sensor (Receiver)** (page 1 of 3)**First**

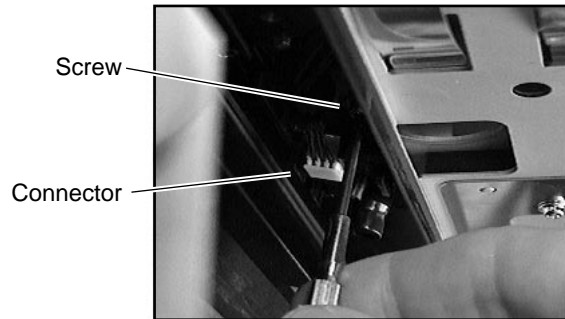
Remove the toner disposal box, photoconductor cartridge, toner cartridges, inner panel 1, top cover, pickup block, and transfer drum assembly. Raise the separation discharge assembly.

For this procedure, you will need a short Phillips screwdriver, no more than 4 inches (10 cm) long.

Do not touch the sensor with your hands. If it gets soiled, clean it with a lint-free paper or cloth.

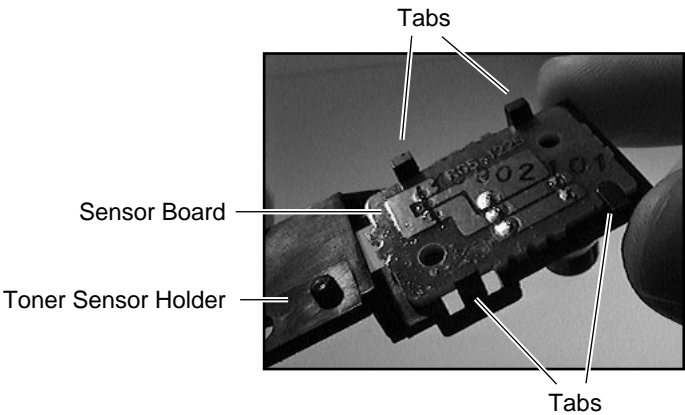
## Toner Sensor (Receiver) (page 2 of 3)

- Now**
- 1 Remove the brass-colored screw that secures the sensor holder to the chassis ceiling above the carousel. Disconnect the connector and remove the sensor and holder from the printer.



Toner Sensor (Receiver) (page 3 of 3)

- 2 Release the four tabs and separate the sensor board from the holder.



**Note:** The sensor board is P/N 922-1559; the toner sensor holder is P/N 922-1308; and the cable going into the board is P/N 922-1328.

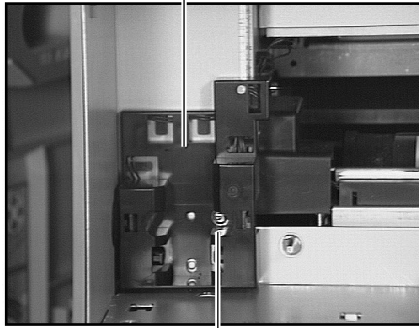


## Oil Sensor Assembly (page 1 of 2)

**First** Remove the fuser access cover and fuser assembly.

**Now** 1 Remove the brass-colored screw.

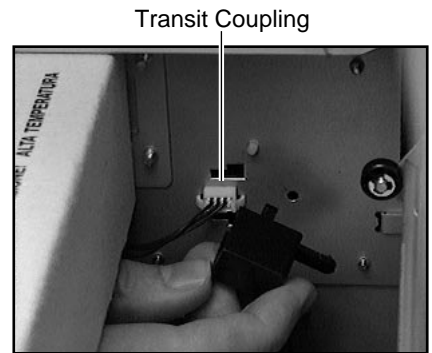
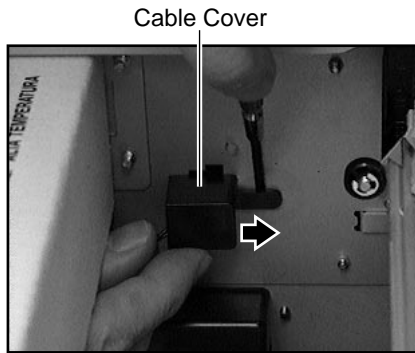
Oil Sensor Assembly



Screw

## Oil Sensor Assembly (page 2 of 2)

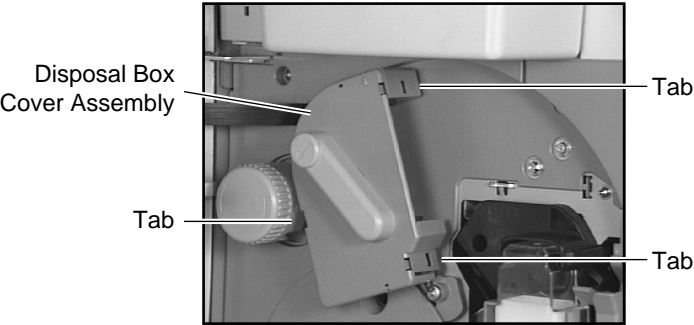
- 2 Raise the top access door and locate the black cable cover on the chassis wall just below where the green brush is mounted. Using a small flat-blade screwdriver, raise the cable cover tab and slide the cover toward the carousel to release the claws. Remove the cable cover from the chassis. Disconnect the oil sensor cable from the transit coupling and remove the oil sensor assembly from the printer.



Disposal Box Cover Assembly (page 1 of 2)

**First** Remove the toner disposal box.

**Now** 1 Release the three tabs and remove the facing panel of the disposal box cover assembly.



## Disposal Box Cover Assembly (page 2 of 2)

- 2 Disconnect the three-wire connector from J631 on the sensor board. Remove the large stepped screw, free the cable from the cable clamp and cable guide, and remove the disposal box cover from the printer.

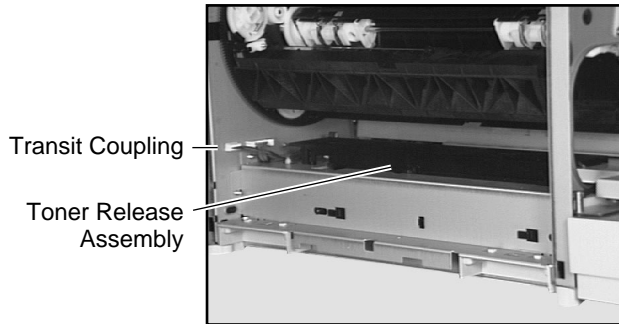


**Note:** The stepped screw is a part of screw kit P/N 076-0501.

## Toner Release Assembly (page 1 of 2)

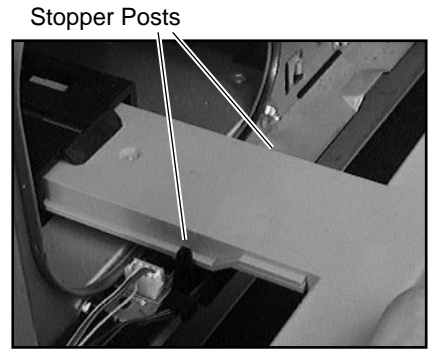
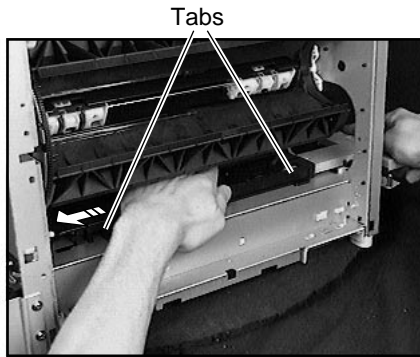
**First** Remove the toner cartridges, front door, inner panel 1, toner carousel guide panel, top cover, and left cover.

**Now** 1 Disconnect the five-wire temperature/humidity connector from the transit coupling on the inside face of the rear chassis.



## Toner Release Assembly (page 2 of 2)

- 2 Release the two tabs, pull the green handle to its full extension, and slide the assembly towards the rear of the printer. Remove the assembly through the left side of the printer.



**Replacement Note:** Pull the green handle to its full extension before seating the assembly into the slots in the chassis. The handle must rest outside the two stopper posts on the ejection/cassette sensor mount.

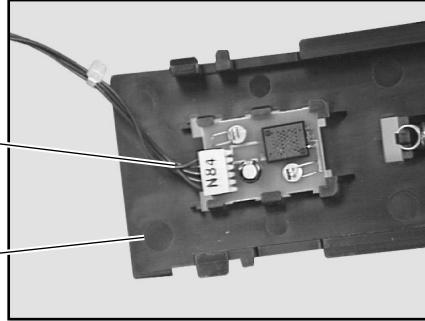
## Temperature/Humidity Sensor

**First** Remove the toner cartridges, front door, inner panel 1, toner carousel guide panel, top cover, left cover, and toner release assembly.

**Now** Slide the sensor board off the toner release assembly.

Temperature/Humidity  
Sensor Board

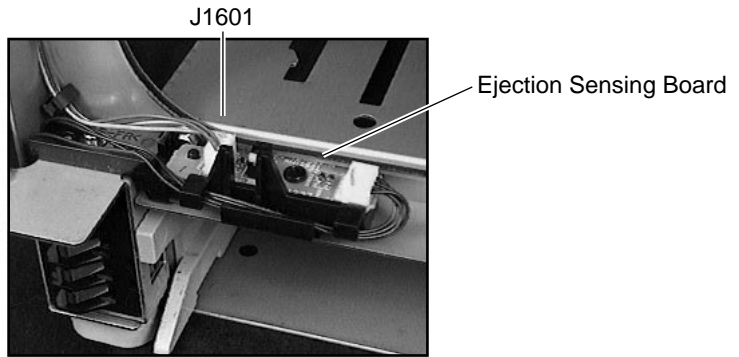
Toner Release  
Assembly



## Ejection Sensing Board (page 1 of 3)

**First** Remove the paper cassette, toner cartridges, front door, inner panel 1, toner carousel guide panel, top cover, left cover, and toner release assembly.

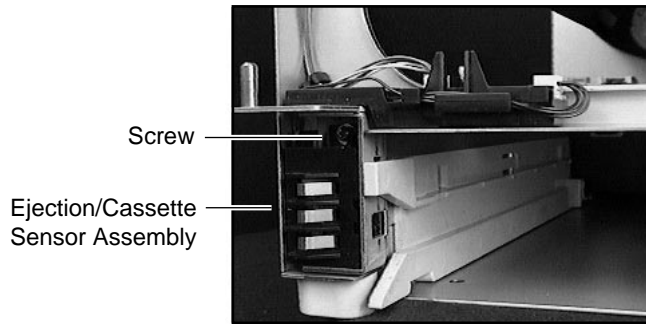
**Now** 1 Disconnect J1601 from the ejection sensing board.





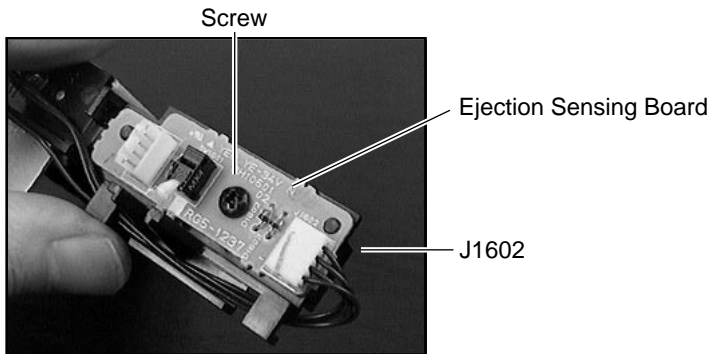
## Ejection Sensing Board (page 2 of 3)

- 2 Remove the brass-colored screw and pull the ejection/cassette sensor assembly from the printer.



## Ejection Sensing Board (page 3 of 3)

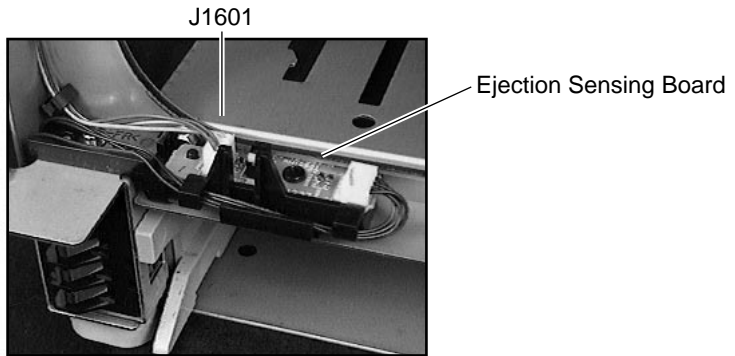
- 3 Disconnect J1602 from the ejection sensing board. Remove the black screw and lift the board from the mounting.



## Cassette Size Sensing Board (page 1 of 5)

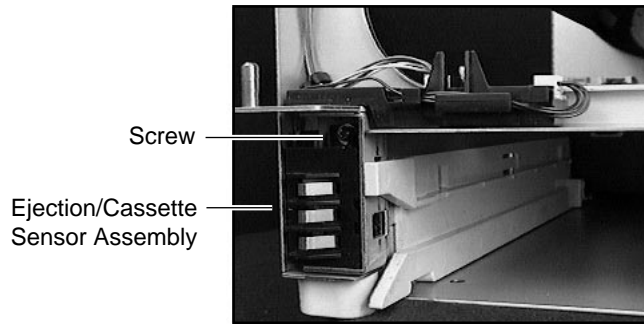
**First** Remove the paper cassette, toner cartridges, front door, inner panel 1, toner carousel guide panel, top cover, left cover, and toner release assembly.

**Now** 1 Disconnect J1601 from the ejection sensing board.



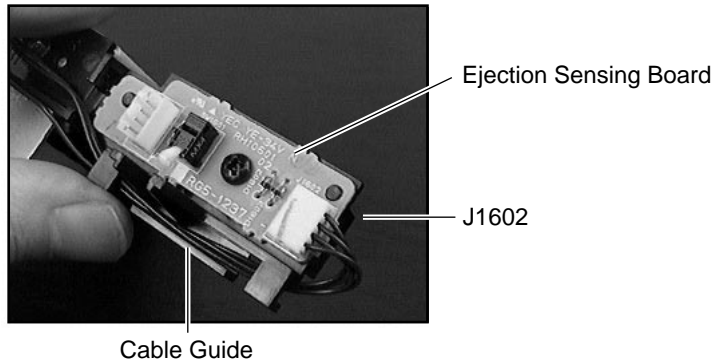
## Cassette Size Sensing Board (page 2 of 5)

- 2 Remove the brass-colored screw and pull the ejection/cassette sensor assembly from the printer.



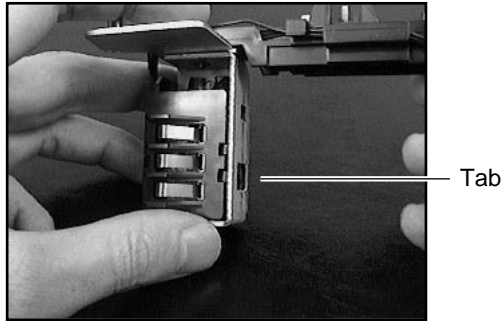
## Cassette Size Sensing Board (page 3 of 5)

- 3 Disconnect J1602 from the ejection sensing board and free the cable from the cable guide.



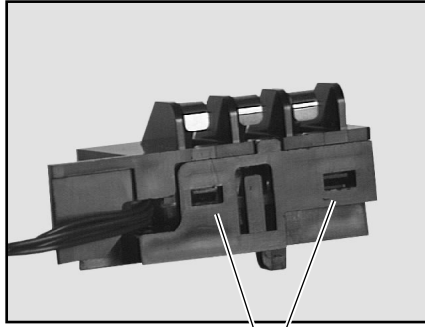
## Cassette Size Sensing Board (page 4 of 5)

- 4 Release the tab and snap the sensor housing upward and out of the metal plate.



## Cassette Size Sensing Board (page 5 of 5)

- 5 Release the two tabs and remove the cover. Disconnect J312, release the tab, and remove the cassette size sensing board.



Tabs

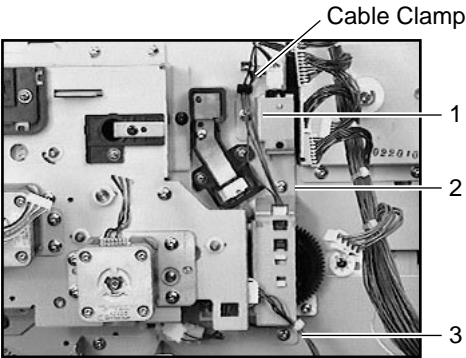
Position Sensor Assembly (page 1 of 2)

- First

Remove the top cover, left cover, rear cover, rear shield plate, mechanical controller mount and board, and main fan.
- Now

1

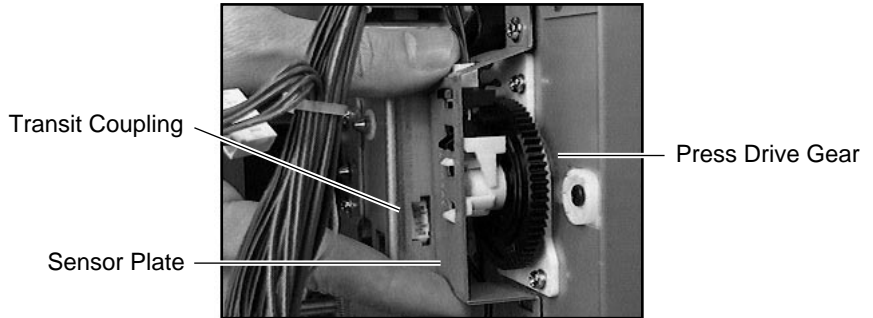
Disconnect the cable from the cable clamp and remove the three silver-colored screws that secure the position sensor assembly to the chassis.





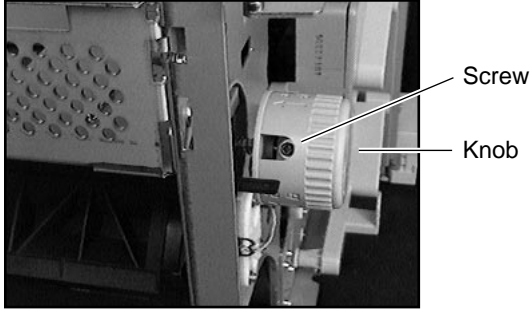
## Position Sensor Assembly (page 2 of 2)

- 2 Disconnect the cable from the transit coupling at the right edge of the printer drive assembly. For clearance purposes, press the coupling inward through the flange to get it out of the way of the position sensor plate. Remove the sensor plate and press drive gear from the printer.



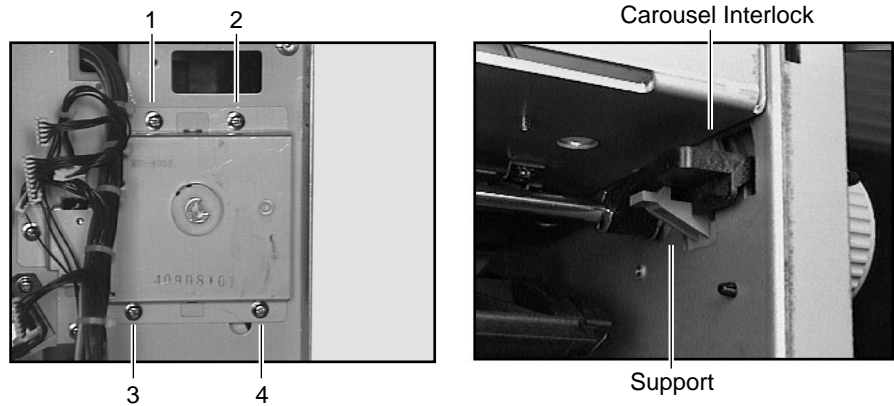
## Carousel Manual Rotary Assembly (page 1 of 2)

- First** Remove the front door, toner carousel guide panel, top cover, left cover, rear cover, rear shield plate, mechanical controller mount and board, and main fan.
- Now** 1 Remove the brass-colored screw and slide the knob, disk, and spring off the end of the shaft.



**Carousel Manual Rotary Assembly** (page 2 of 2)

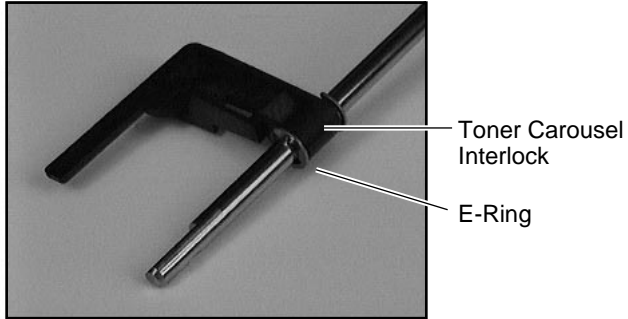
- 2 Remove the four silver-colored screws that secure the carousel manual rotary assembly to the chassis, lift the carousel interlock to clear the gray plastic support at the knob-end of the assembly, and remove the assembly from the printer.



## Toner Carousel Interlock

**First** Remove the top cover, left cover, rear cover, rear shield plate, mechanical controller mount and board, main fan, and carousel manual rotary assembly.

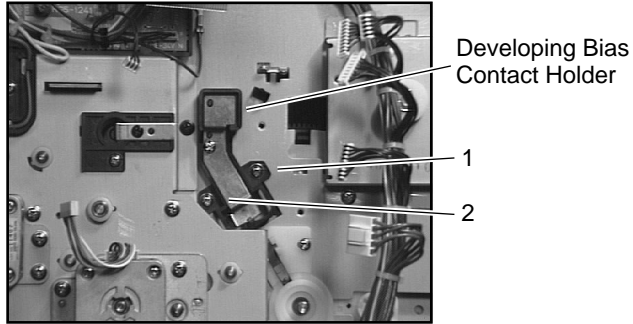
**Now** Remove the E-ring and slide the interlock off the shaft.



## Toner Carousel Assembly (page 1 of 5)

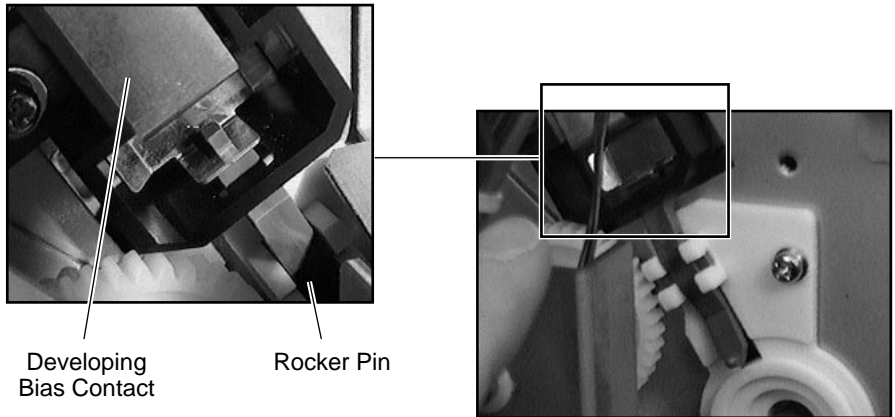
**First** Remove the toner disposal box, photoconductor cartridge, toner cartridges, front door, inner panel 1, toner carousel guide panel, top cover, left cover, rear cover, rear shield plate, mechanical controller mount and board, main fan, carousel manual rotary assembly, and position sensor assembly.

**Now** 1 Remove the two brass-colored screws and lift the developing bias contact holder off the chassis.



## Toner Carousel Assembly (page 2 of 5)

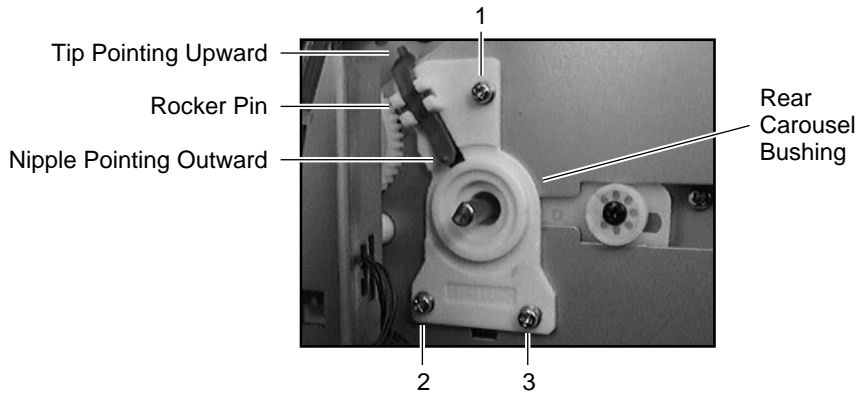
**Replacement Note:** Make sure to install the rocker pin so that the end with the rectangular tip seats in the cutout at the bottom of the developing bias contact.



**Note:** The press drive gear actuates this rocker pin during cartridge press to complete the developing bias circuit into the toner cartridge.

## Toner Carousel Assembly (page 3 of 5)

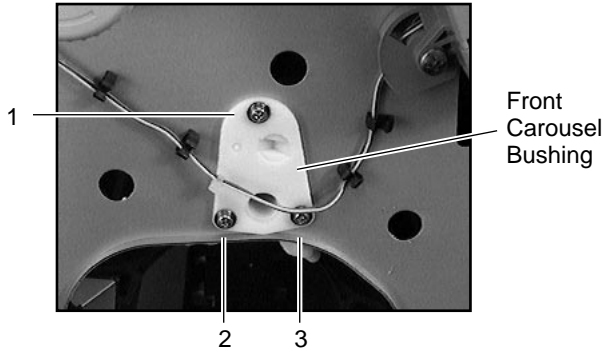
- 2 Remove the three silver-colored self-tapping screws and remove the rear carousel bushing from the chassis. You may have to shift the carousel slightly for the bushing to clear the printer drive assembly.



**Replacement Note:** If the rocker pin comes loose from the bushing, make sure to reinstall it with the tip high and pointing upward and the nipple low and pointing outward.

## Toner Carousel Assembly (page 4 of 5)

- 3 Remove the three brass-colored screws and remove the front carousel bushing. If necessary, unclamp the cable to free the bushing.



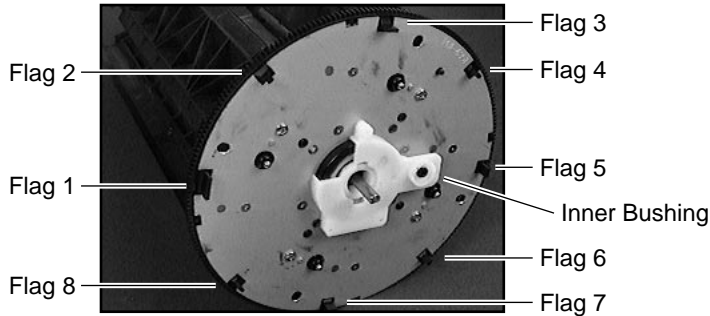
**Replacement Note:** This bushing is keyed. Set it in position in the chassis and manually rotate the carousel's central rotary mechanism until the bushing seats solidly in place. The front and rear carousel bushings secure the central rotary to the chassis so that the rotary does not rotate with the carousel.



Toner Carousel Assembly (page 5 of 5)

- 4 Slide the carousel assembly out the left side of the printer.

**Caution:** Take care not to damage the carousel flags during this procedure. A broken flag will result in a toner carousel error and prevent the printer from operating. For more information see Chapter 1.



**Replacement Note:** Make sure that the circular guide on the inner bushing slides into the slotted cutout in the chassis. The carousel will not fit into the printer otherwise. (See in-place photo under step 2.)

## Sheet Feeder Removal (page 1 of 2)

### First

No first steps are required.

**Note:** The Color LaserWriter 12/600 PS is very heavy and requires two people to lift it. The right side of the printer is heavier than the left.

### Now

- 1 Unplug the sheet feeder power cord from the printer.

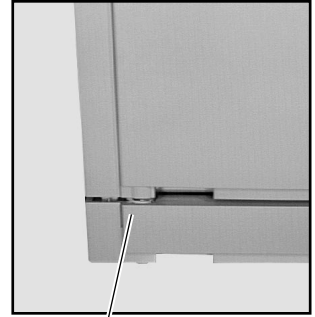


## Sheet Feeder Removal (page 2 of 2)

- 2 Remove the two cotter pins that secure the printer to the feeder. Grip the two hand recesses on each side of the printer and remove the printer from the sheet feeder.



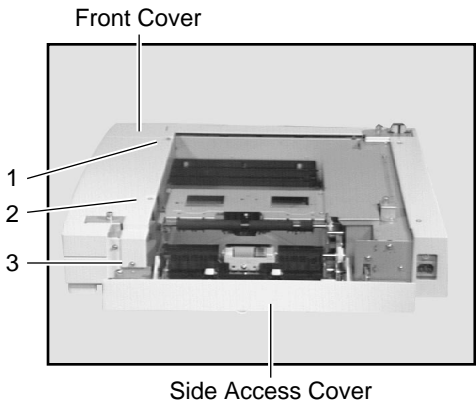
Cotter Pin 1



Cotter Pin 2

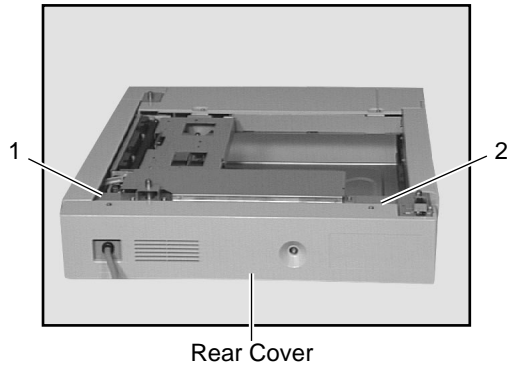
Sheet Feeder Front Cover

- First
- Remove the paper cassette.
- Now
- Open the side access cover. Remove the three brass-colored screws. Lift the front cover up to release the three hidden claws along the outside edge of the feeder, and remove the cover from the feeder.



## Sheet Feeder Rear Cover

- First** Remove the cassette.
- Now** Remove the two brass-colored screws and remove the rear cover from the sheet feeder.

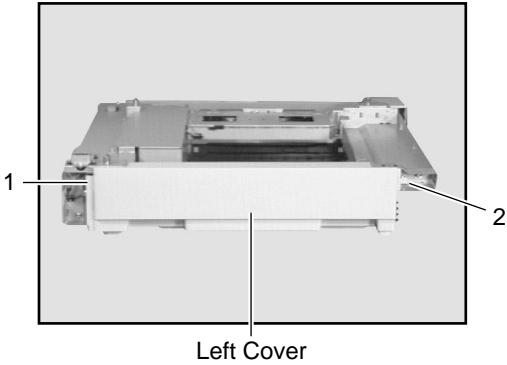


Sheet Feeder Left Cover

- First

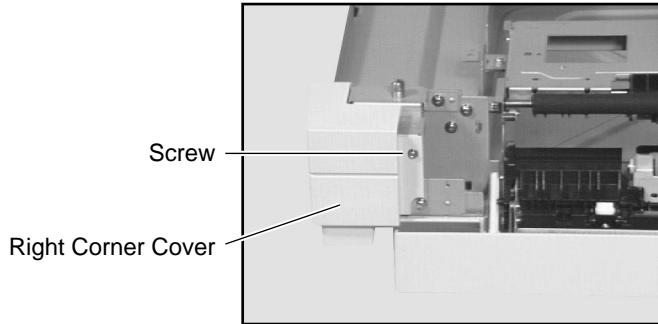
Remove the cassette, front cover, and rear cover.
- Now

Remove the two brass-colored screws and remove the left cover from the sheet feeder.



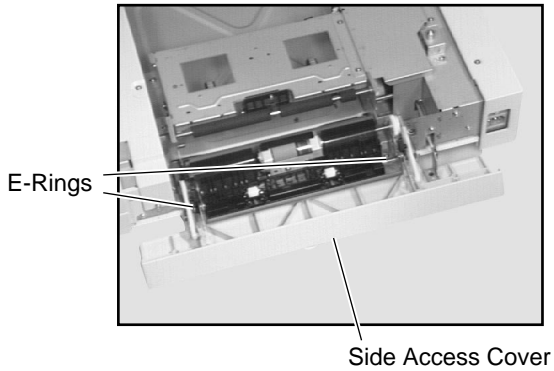
## Sheet Feeder Right Corner Cover

- First** Remove the cassette and front cover.
- Now** Remove the brass-colored screw and lift the right corner cover from the sheet feeder.



## Sheet Feeder Side Access Cover (page 1 of 2)

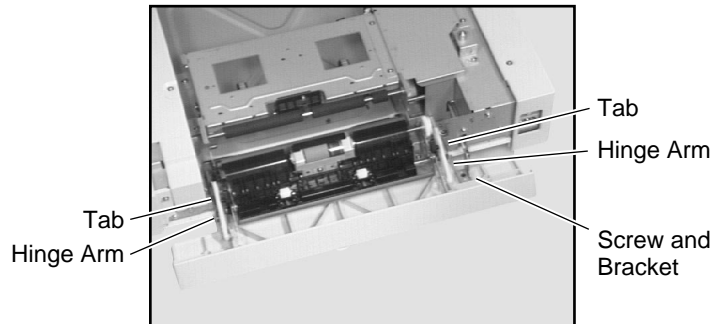
- First** Remove the cassette.
- Now** 1 Open the side access cover. Remove the two E-rings that hold the hinge pins to the pickup block.





## Sheet Feeder Side Access Cover (page 2 of 2)

- 2 While holding the metal bracket in place, remove the black screw that holds the metal bracket to the cover. Press the black tabs and slide the two white plastic hinge arms off the pickup block. Free the side access cover from its hinge pins and remove it from the sheet feeder.



Sheet Feeder Pickup Block (page 1 of 2)

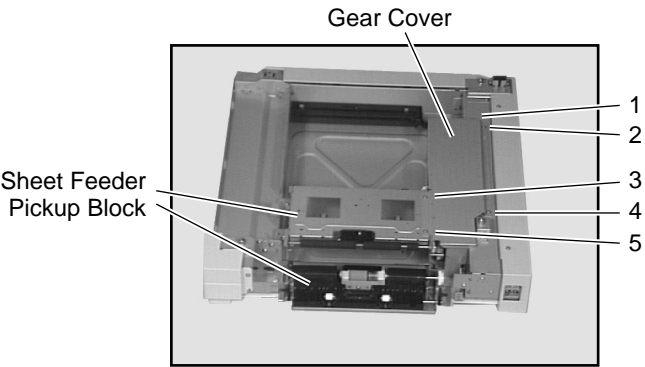
First

Remove the cassette, front cover, and side access cover.

The sheet feeder pickup block consists of two assemblies, the front paper pickup assembly (P/N 922-1358) and the rear paper pickup assembly (P/N 922-1359).

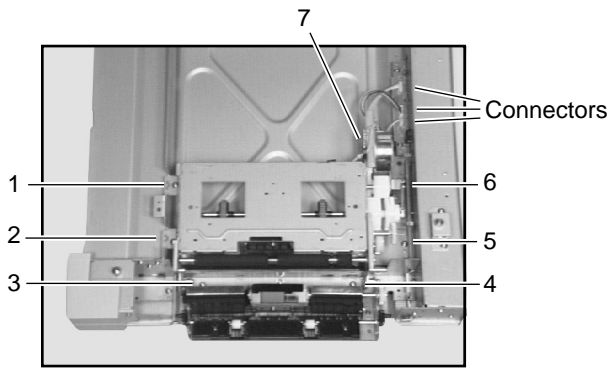
Now

- 1
- Remove the five silver-colored screws and lift the metal gear cover from the sheet feeder.



Sheet Feeder Pickup Block (page 2 of 2)

- 2 Remove the seven large silver-colored screws, disconnect the three connectors, and lift the pickup block from the sheet feeder.

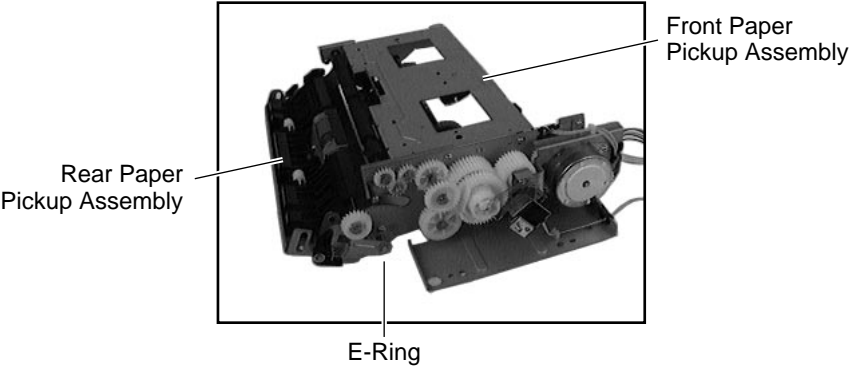


## Sheet Feeder Front Paper Pickup Assembly

- First

Remove the cassette, front cover, side access cover, and pickup block.
- Now

Remove the E-ring at the right hinge pin of the pickup block and separate the front assembly from the rear assembly.

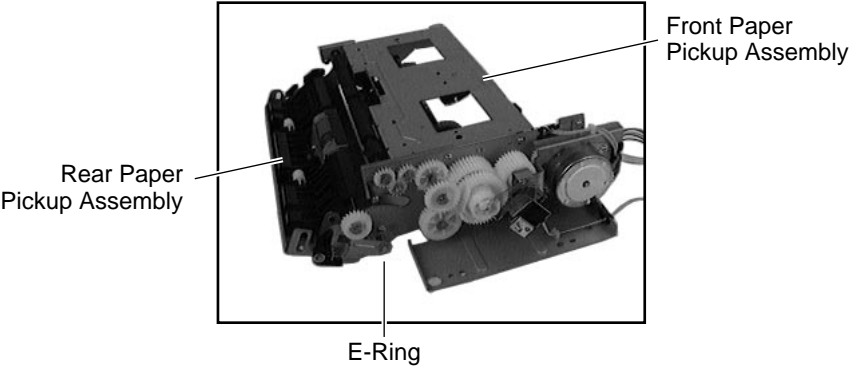


Sheet Feeder Rear Paper Pickup Assembly

- First

Remove the cassette, front cover, side access cover, and pickup block.
- Now

Remove the E-ring at the right hinge pin of the pickup block and separate the front assembly from the rear assembly.



## Oil-Overflow Sensor (PS10) (page 1 of 6)

**First** Remove the fuser access cover, fuser oil bottle, and the fuser assembly. Set the fuser assembly down with the delivery side facing you.

**Note:** The photo-interrupter at oil-overflow sensor is available as P/N 922-1353

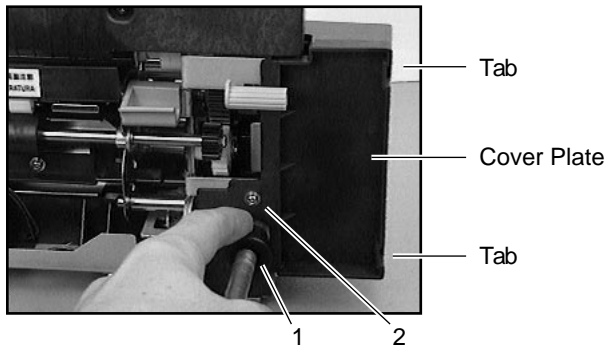
**Now** 1 Remove the tension spring that goes between the delivery roller mechanism and the bottom plate of the fuser.

Tension Spring



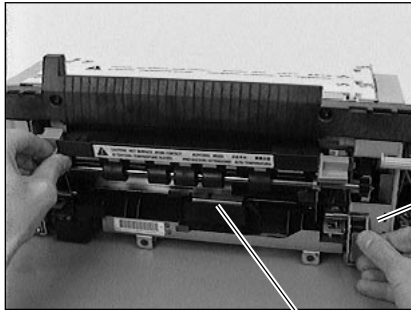
## Oil-Overflow Sensor (PS10) (page 2 of 6)

- 2 Remove the two brass-colored screws, one that secures the right knob to the fuser, and the other that secures the black cover plate to the fuser. Release the two tabs at the right end of the fuser and remove the black cover plate.



## Oil-Overflow Sensor (PS10) (page 3 of 6)

- 3 Remove the silver-colored screw that secures the metal pivot mount to the fuser and slide the mount about 3/4 inch (2 cm) to the right. Remove the delivery roller mechanism from the fuser.



Pivot Mount

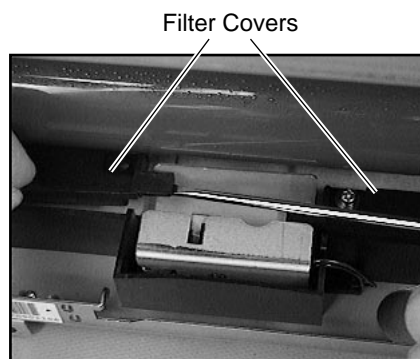
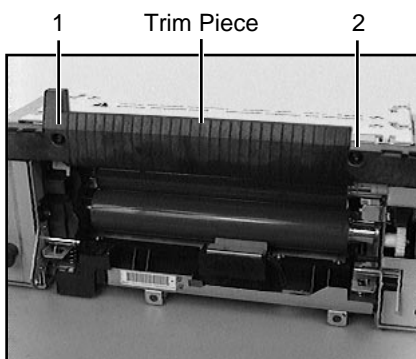
Delivery Roller Mechanism



## Oil-Overflow Sensor (PS10) (page 4 of 6)

- 4 Remove the two black screws and lift the long black trim piece from the fuser. Remove the four brass-colored screws that secure the two filter covers to the fuser chassis and remove the covers from the fuser.

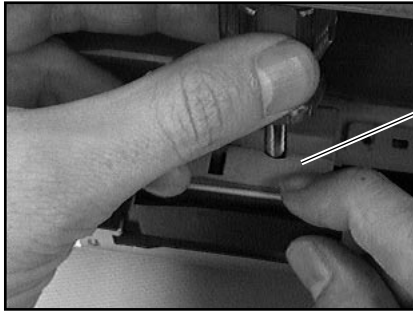
**Note:** You need a small thin Phillips screwdriver to get at the four screws securing the filter covers. Be careful not to damage the lower fuser roller when removing these screws.



## Oil-Overflow Sensor (PS10) (page 5 of 6)

**Note:** For the following step, you will need a short Phillips screwdriver no more than 3.5 inches (8.9 cm) in length.

- 5 Using the short screwdriver, remove the brass-colored screw and lift the sensor mount plate away from the fuser.

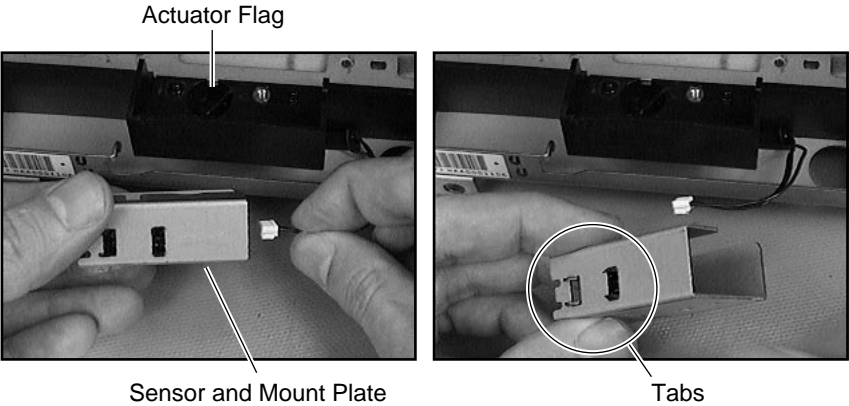


Sensor Mount Plate

**Replacement Note:** Be very careful to align the flag on the actuator with the slot in the bottom of the mount plate. Failure to do so could result in oil-overflow conditions going undetected.

**Oil-Overflow Sensor (PS10)** (page 6 of 6)

- 6 Remove the connector from sensor PS10. Release the four tabs and separate the sensor from the mount plate.



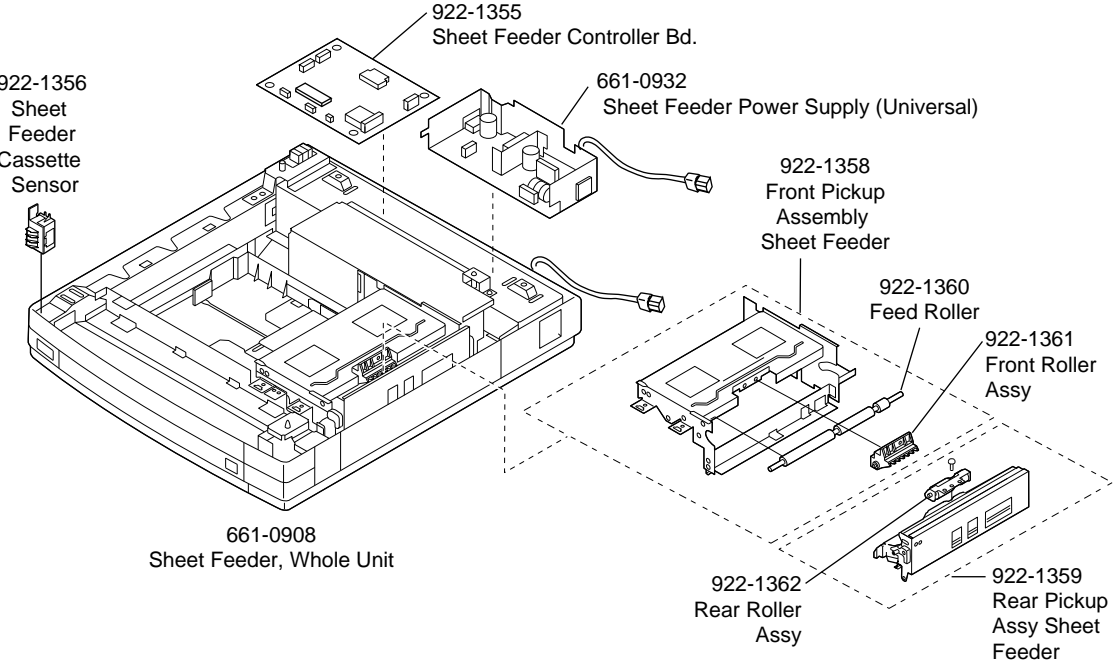
Finished Goods Parts

Description

The parts below are available through Finished Goods. This list contains both standard and optional parts.

Color LaserWriter Toner Cartridge, Cyan .....	M3753G/A
Color LaserWriter Toner Cartridge, Magenta .....	M3760G/A
Color LaserWriter Toner Cartridge, Yellow .....	M3758G/A
Color LaserWriter Toner Cartridge, Black .....	M3756G/A
Color LaserWriter 12/600 PS 250-Sheet Feeder .....	M3762G/A
Color LaserWriter 12/600 PS Universal Cassette .....	M3874G/A
Color LaserWriter 12/600 PS Internal Hard Disk Drive .....	M3875G/A
Color LaserWriter Photoconductor Replacement Kit .....	M3761G/A
110 V Color LaserWriter Fuser Replacement Kit .....	M3867G/A
220 V Color LaserWriter Fuser Replacement Kit .....	M4234G/A
Color LaserWriter 12/600 PS 16MB Memory Expansion Kit .....	M4255LL/A
Color LaserWriter Fuser Oil .....	M3755G/A
Color LaserWriter Transparencies A4 .....	M3877G/A
Color LaserWriter Transparencies Letter .....	M3876G/A
Apple HDI-30 SCSI Cable .....	M2538LL/A
Apple Ethernet Thin Coax Transceiver .....	M0329LL/A
Apple Ethernet Twisted Pair Transceiver .....	M0437LL/A
Apple Ethernet AUI Adapter .....	M0432LL/A
Apple 1284 Parallel I/O Cable .....	M0435ZM/A
Apple SCSI Cable Extender .....	M0208
Apple SCSI Cable Terminator II (Black) .....	M5871G/A

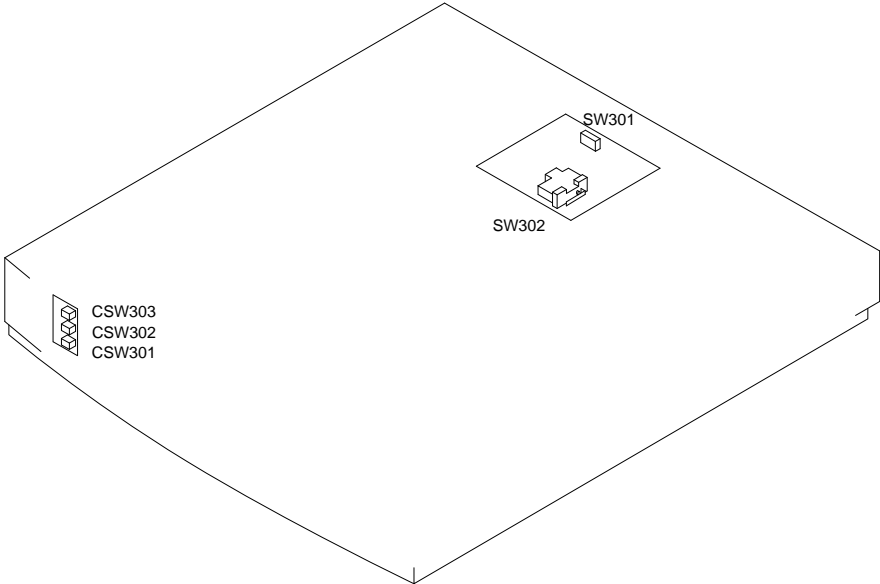
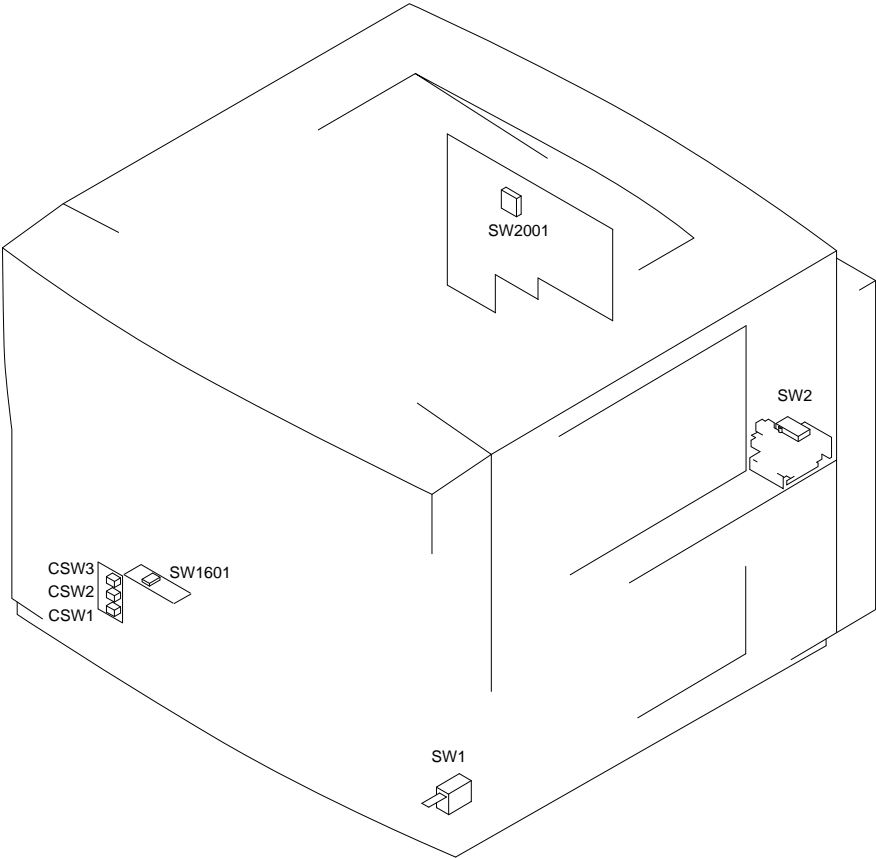
Sheet Feeder Exploded View



Switches

Locations

The illustrations below show switch locations for the Color LaserWriter 12/600 PS and the optional sheet feeder.



Descriptions

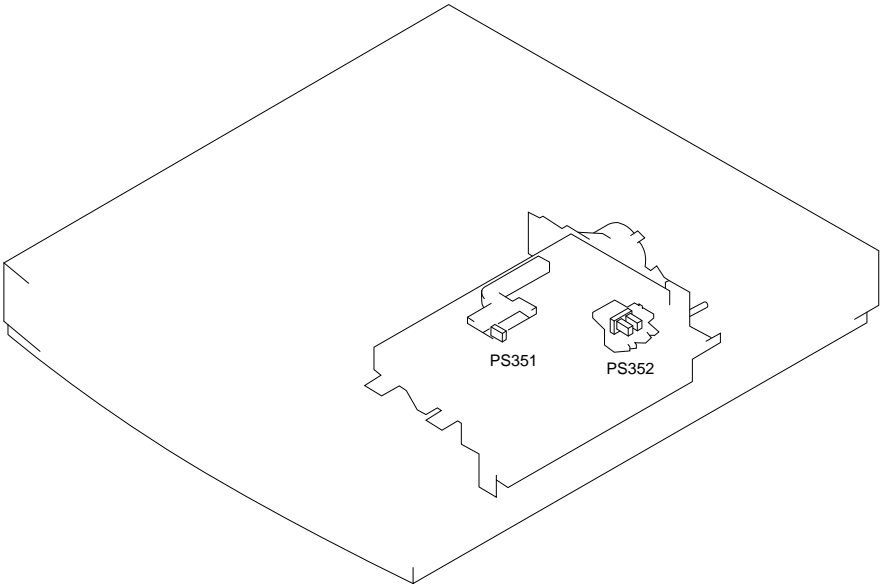
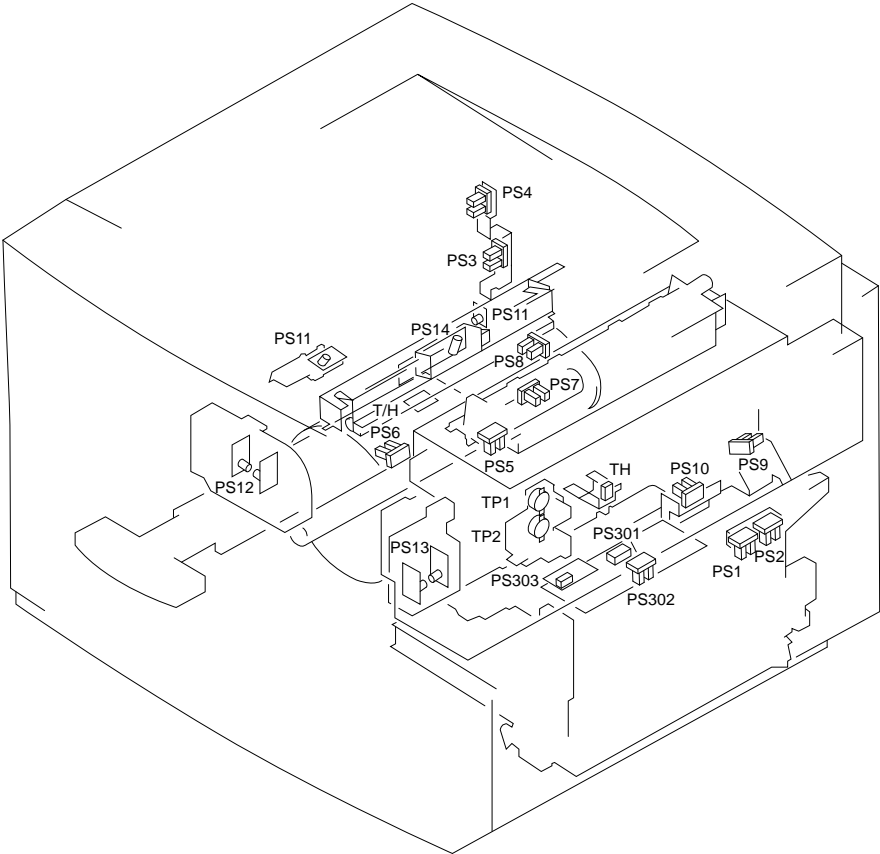
The table below describes the switches for the Color LaserWriter 12/600 PS and the optional sheet feeder.

Designation	Name	Availability
SW1	Power switch	P/N 922-1320
SW2	Door switch <ul style="list-style-type: none"><li>• An actuator on the front door (P/N 922-1317) strikes a transfer rod that is in contact with the door switch assembly.</li><li>• An actuator on the fuser access cover (P/N 922-1339) strikes a lever that is in contact with the door switch assembly.</li><li>• An actuator on the pickup block cover (P/N 922-1305) strikes the door switch assembly directly.</li></ul> All three of these must be closed for the switch to be pressed.	P/N 922-1351
SW1601	Ejection sensing switch	Part of the cassette sizing sensor assembly (P/N 922-1623).
SW2001	Mechanical controller reset switch This switch was used during printer development and was removed early in production. It may not be present on your unit.	
CSW1	Cassette-size sensing switch 1	Part of the cassette sizing sensor assembly (P/N 922-1623).
CSW2	Cassette-size sensing switch 2	Part of the cassette sizing sensor assembly (P/N 922-1623).
CSW3	Cassette-size sensing switch 3	Part of the cassette sizing sensor assembly (P/N 922-1623).
SW301	Sheet feeder side registration adjustment switch	Part of sheet feeder controller board (P/N 922-1355)
SW302	Sheet feeder right door switch	Part of sheet feeder controller board (P/N 922-1355)
CSW301	Cassette-size sensing switch 1 (Sheet feeder)	
CSW302	Cassette-size sensing switch 2 (Sheet feeder)	
CSW303	Cassette-size sensing switch 3 (Sheet feeder)	

Sensors

Locations

The illustrations below show sensor locations for the Color LaserWriter 12/600 PS and the optional sheet feeder.





Descriptions  
(1 of 2)

The table below describes the photo-interrupter sensors used in the Color LaserWriter 12/600 PS and the optional sheet feeder. All of these sensors consist of two basic elements, one electrical (a U-shaped, light-emitting sensor), and one mechanical (a flag that is actuated by some other movement within the printer).

When the “flag” of the actuator passes into the U, the flag interrupts the light and the controller reacts accordingly. When troubleshooting this type of sensor, first check that the mechanical actuator is free to move and is not broken, then concentrate on the electrical elements.

Designation		Name/Function	Availability
Photo-interrupter	PS1	Manual feed paper-present sensor	Sensor/Actuator: Part of the multipurpose pickup assembly (P/N 922-1322)
	PS2	Manual feed paper-width sensor (detects B5 paper)	Sensor/Actuator: Part of the multipurpose pickup assembly (P/N 922-1322)
	PS3	Toner cartridge position sensor	Sensor: P/N 922-1353 Actuator: Toner press drive gear (P/N 922-1713).
	PS4	Toner carousel position sensor	Sensor: P/N 922-1352 Actuators: Part of the toner carousel assembly (P/N 922-1369)
	PS5	Cleaning belt sensor	Sensor/Actuator: Part of the paper delivery assembly (P/N 922-1340)
	PS6	Attraction sensor	Sensor/Actuator: Part of the transfer drum assembly (P/N 661-0906)
	PS7	Separation sensor	Sensor/Actuator: Part of the transfer drum assembly (P/N 661-0906)
	PS8	Transfer drum top sensor	Sensor/Actuator: Part of the transfer drum assembly (P/N 661-0906)
	PS9	Paper delivery sensor	Sensor/Actuator: Part of the fuser assembly (P/Ns 661-0900/661-0901)
	PS10	Oil overflow sensor	Sensor: P/N 922-1353 Actuator: Part of the fuser assembly (P/Ns 661-0900/661-0901)
	PS302	Paper registration sensor	Sensor: Part of the cassette pickup assembly board (P/N 922-1311) Actuator: Part of the cassette pickup assembly (P/N 661-0907)
	PS352	Sheet feeder pickup sensor	Sensor/Actuator: Part of the front sheet feeder pickup assembly (P/N 922-1358)

Descriptions  
(2 of 2)

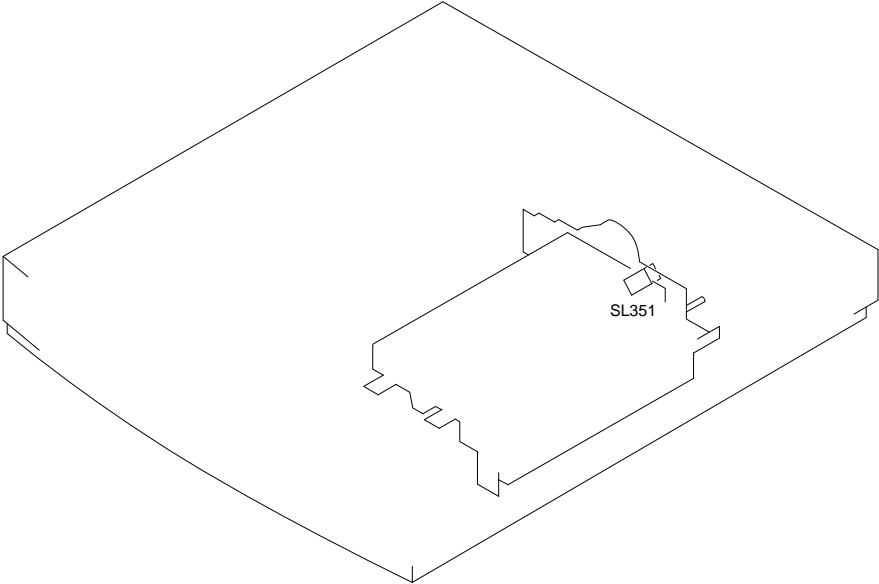
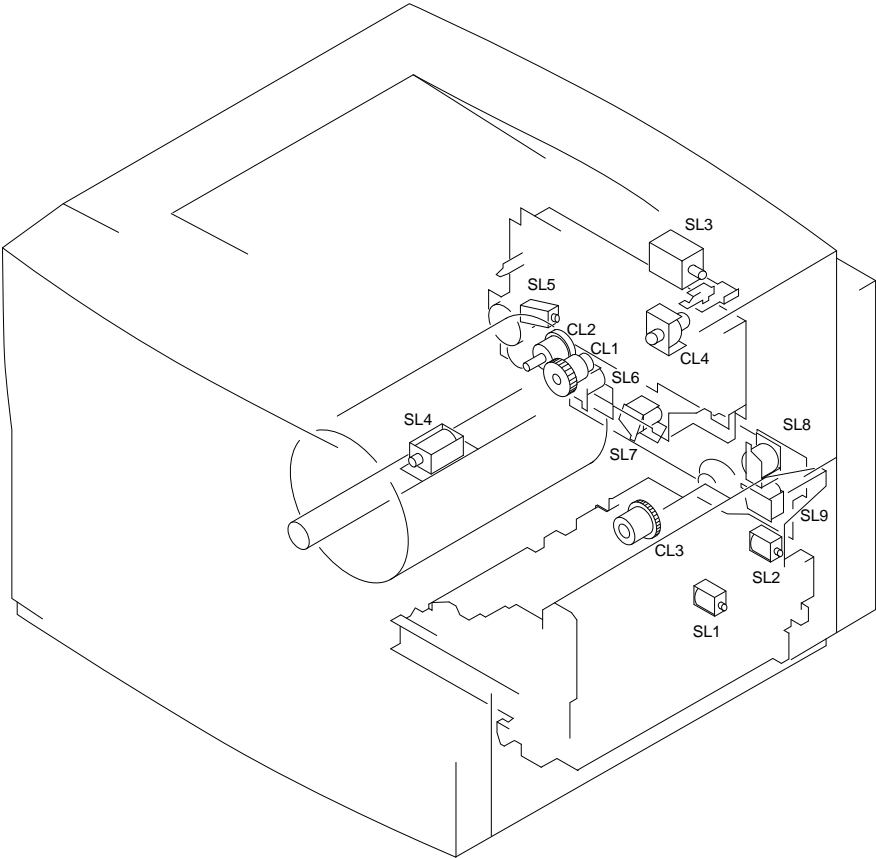
The table below describes the other sensors used in the Color Laser-Writer 12/600 PS.

Designation		Name/Function	Availability
Photo-reflector	PS301	Cassette paper-present sensor	Part of the cassette pickup assembly board (P/N 922-1311)
	PS303	Paper leading-edge sensor	Part of the cassette pickup assembly board (P/N 922-1311)
	PS351	Cassette paper-present sensor (sheet feeder)	Part of the front sheet feeder pickup assembly (P/N 922-1358)
Photosensor	PS11	Toner sensor	Emitter: P/N 922-1558 Receiver: P/N 922-1559
	PS12	Waste toner sensor	Emitter/Receiver: Part of the disposal box cover assembly (P/N 922-1342)
	PS13	Oil-low sensor	Emitter/Receiver: Part of the oil assembly sensor (P/N 922-1407) Actuator: Floating ball within the fuser assembly (P/Ns 661-0900/661-0901)
	PS14	Calibration density sensor	Part of the density sensor assembly (P/N 922-1310)
Thermistor	TH	Detects the surface temperature of the lower fuser roller	Part of the fuser assembly (P/Ns 661-0900/661-0901)
Thermoswitch	TP1	Detects abnormally high temperature of the upper fuser roller	Part of the fuser assembly (P/Ns 661-0900/661-0901)
	TP2	Detects abnormally high temperature of the lower fuser roller	Part of the fuser assembly (P/Ns 661-0900/661-0901)
Sensor	T/H	Temperature/humidity sensor	P/N 922-1561

Solenoids/Clutches

Locations

The illustrations below show solenoid and clutch locations for the Color LaserWriter 12/600 PS and the optional sheet feeder.



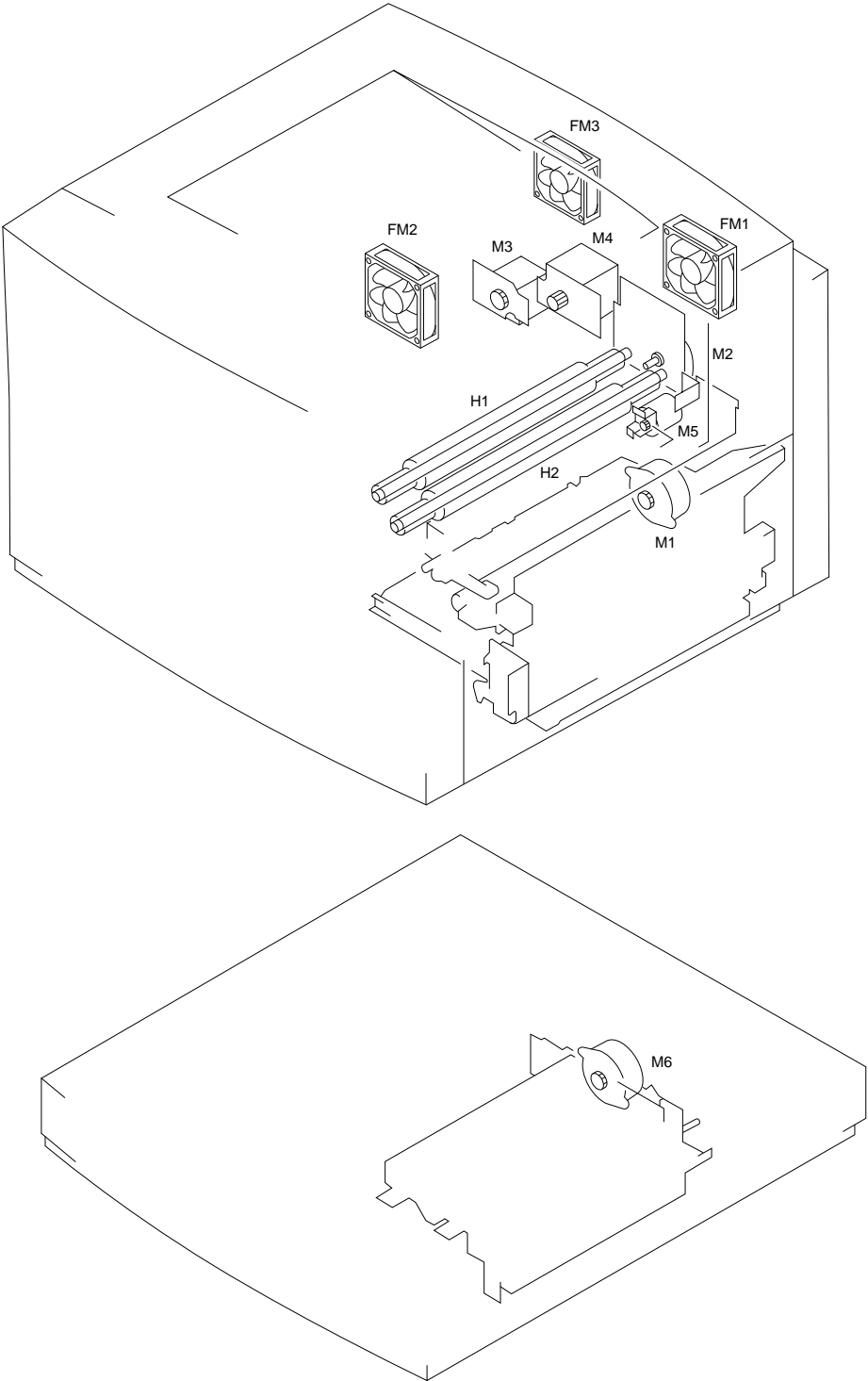
Descriptions

The table below describes the other solenoids and clutches used in the Color LaserWriter 12/600 PS.

Designation		Name/Function	Availability
Solenoid	SL1	Cassette feed solenoid	Part of the cassette pickup assembly (P/N 661-0907)
	SL2	Manual feed solenoid	Part of the multipurpose pickup assembly (P/N 922-1322)
	SL3	Cleaning belt drive solenoid	P/N 922-1406
	SL4	Gripper drive solenoid	Part of the transfer drum assembly (P/N 661-0906)
	SL5	Separation claw solenoid	Part of the transfer drum assembly (P/N 661-0906)
	SL6	Attraction roller press solenoid	P/N 922-1403
	SL7	Transfer drum press solenoid	P/N 922-1403
	SL8	Transfer drum cleaner press solenoid	P/N 922-1403
	SL9	Discharge roller press solenoid	P/N 922-1404
	SL351	Cassette feed solenoid (sheet feeder)	Part of the front sheet feeder pickup assembly (P/N 922-1358)
Clutch	CL1	Toner carousel brake clutch	Part of the printer drive assembly (P/N 922-1334)
	CL2	Toner carousel drive clutch	Part of the printer drive assembly (P/N 922-1334)
	CL3	Registration roller clutch	Part of the cassette pickup assembly (P/N 661-0907)
	CL4	Fuser assembly drive clutch	Part of the printer drive assembly (P/N 922-1334)

Motors/Fans/Heaters

**Locations**      The illustrations below show fan, motor, and fuser heater locations for the Color LaserWriter 12/600 PS and the optional sheet feeder.



Descriptions

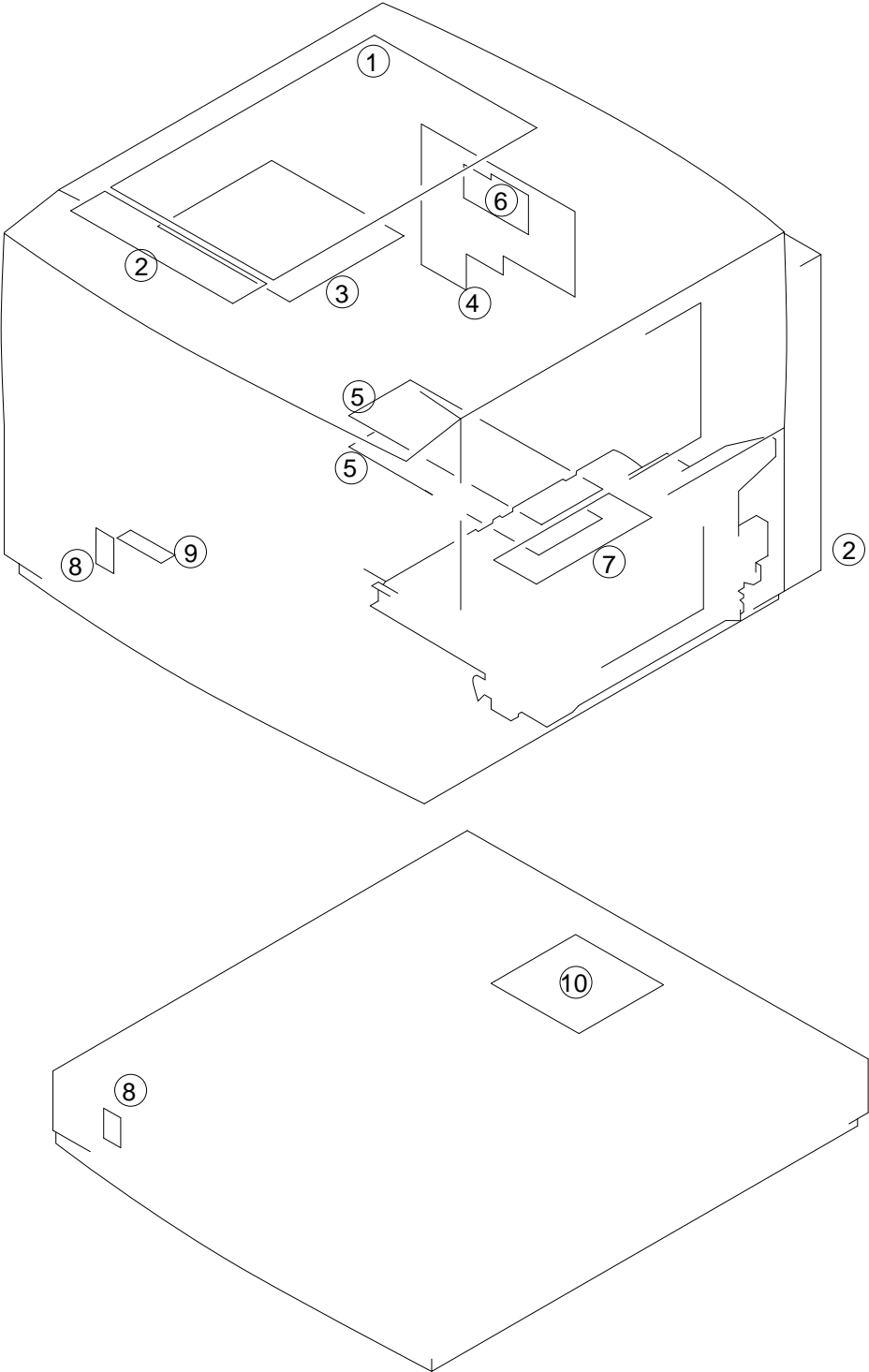
The table below describes the fan, motor, and fuser heaters used in the Color LaserWriter 12/600 PS.

Designation		Name/Function	Availability
Motor	M1	Pickup motor	Part of the cassette pickup assembly (P/N 661-0907)
	M2	Main motor	P/N 922-1370
	M3	Toner carousel motor	Part of the printer drive assembly (P/N 922-1334)
	M4	Drum motor	Part of the printer drive assembly (P/N 922-1334)
	M5	Cleaning brush motor	Part of the transfer drum cleaning assembly (P/N 922-1368)
	M6	Sheet feeder motor	Part of the front sheet feeder pickup assembly (P/N 922-1358)
Fan	FM1	Fuser fan	P/N 922-1348
	FM2	Main fan	P/N 922-1349
	FM3	I/O controller fan	P/N 922-1350
Fuser Heater	H1	Upper fuser roller heater	Part of the fuser assembly (P/Ns 661-0900/661-0901)
	H2	Lower fuser roller heater	Part of the fuser assembly (P/Ns 661-0900/661-0901)

Circuit Boards

Locations

The illustrations below show circuit board locations for the Color LaserWriter 12/600 PS and the optional sheet feeder.



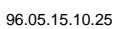
Descriptions

The table below describes the major circuit boards used in the Color LaserWriter 12/600 PS and the optional sheet feeder.

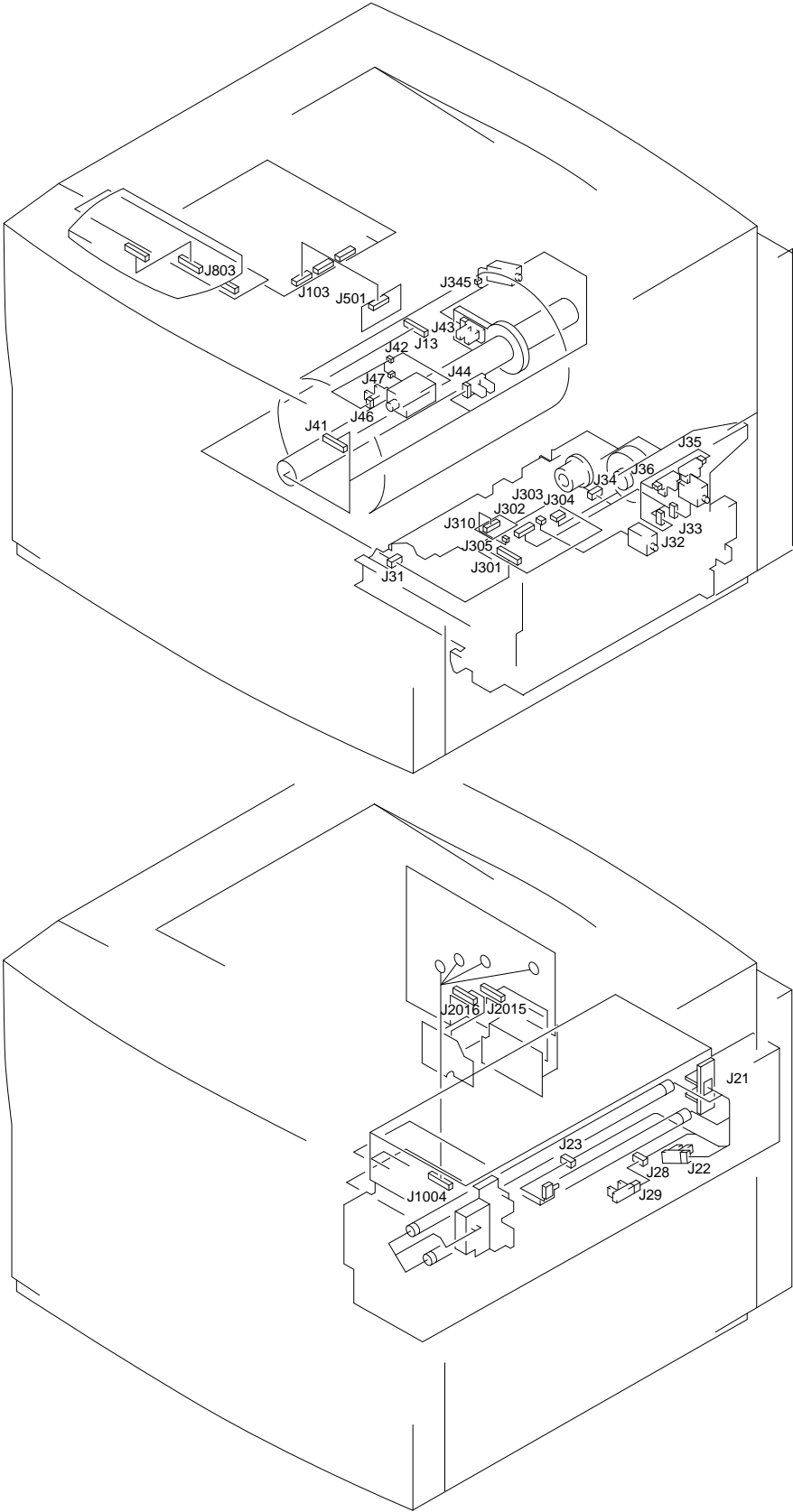
No.	Name/Function	Availability
1	I/O controller board	P/N 661-0133
2	I/O interconnect board Relays signals between the DC controller and the I/O controller boards.	P/N 922-1319
3	DC controller board Controls printer functions (laser/scanner control, image stabilization control, fuser temperature control, I/O control, and various other functions)	P/N 661-0898
4	Mechanical controller board Controls the various loads and various detection functions (motors, developing unit, fuser assembly, transfer drum peripherals, pickup/high voltage/sheet feeder, etc.).	P/N 661-0899
5	High-voltage power supply Applies voltage in sequential correspondence with primary charging, developing, transfer, discharging, attraction, and separation.	P/N 661-0905
6	Separation high-voltage transfer board Outputs separation voltage to the fuser assembly and the separation discharge assembly.	P/N 922-1610
7	Cassette pickup assembly board Controls the pickup system loads.	P/N 922-1311
8	Cassette size-sensing board Detects the cassette size.	P/N 922-1623
9	Ejection-sensing board Detects the pulling of the toner release handle.	P/N 922-1623
10	Sheet feeder controller board	P/N 922-1355



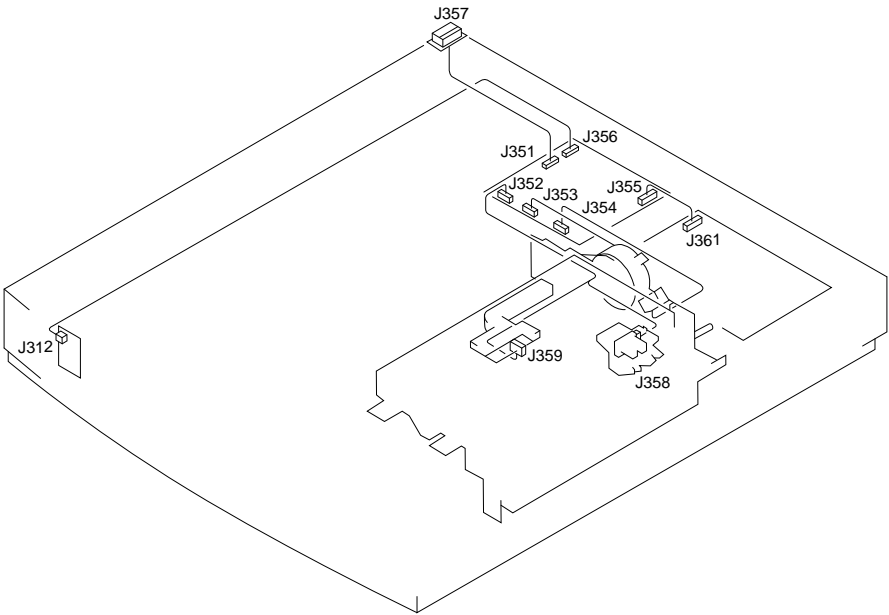
**1 of 3**

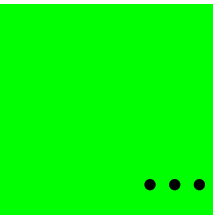


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3 of 3





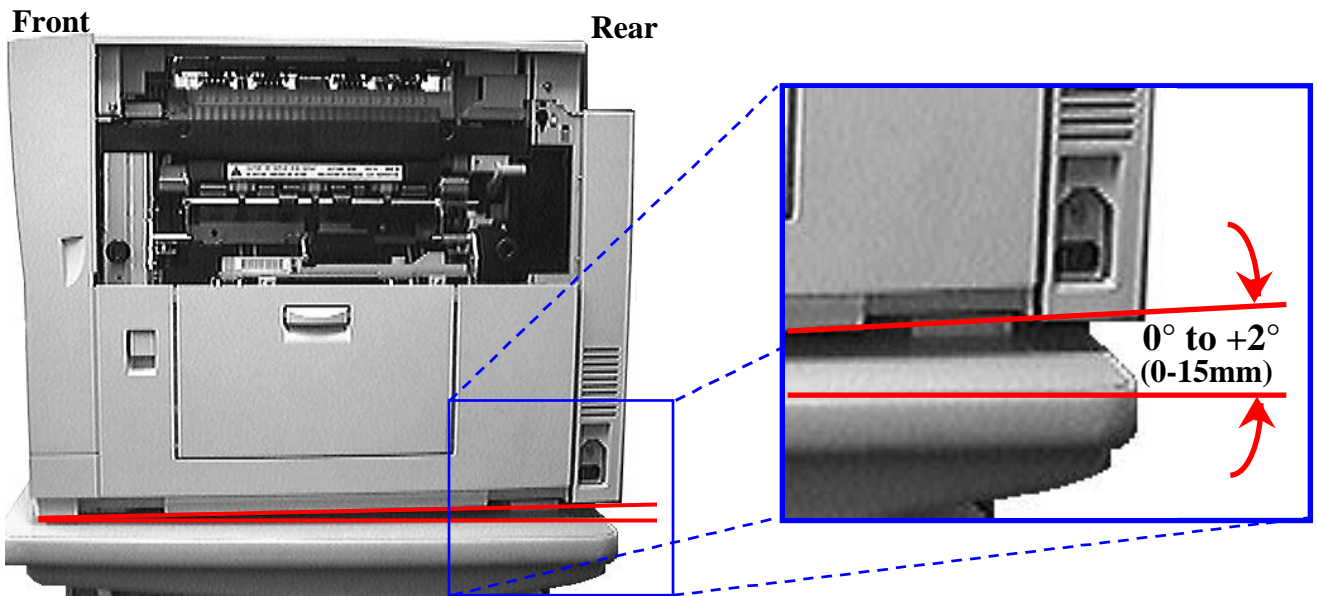
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## Bulletins



Almost any non-compressible flat object can be used as a shim when leveling the Color LaserWriter. Items commonly found at customer locations which can be used include Post-It Notes™, note cards, paper, magazines, etc. Other materials that can be cut to size include wood, plastic, and metal. Post-It Notes™ work well because the shim height can be easily adjusted by tearing off or adding pieces of paper. Install the shims under one or more of the small plastic feet found on the bottom of the printer.

Engineering is working to identify and make available shims specially designed for leveling the Color LaserWriter. Continue to use one or more of the readily available items listed above until the new shims are available.



**Figure 4- Side view of printer with leveling diagram**

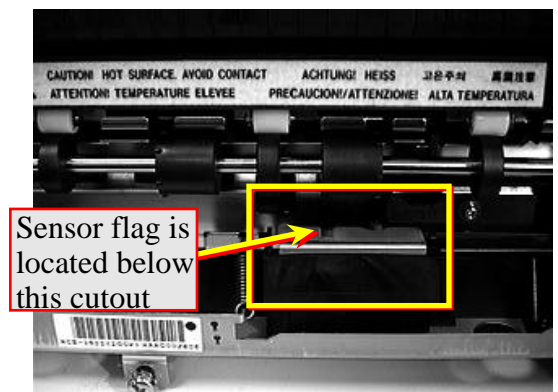
## **Pump The Fuser Jam Release Lever To Remove Excess Oil**

Open the fuser access door to locate the teal green fuser paper jam release lever. Pump the lever at least 50 times to manually remove excess oil from the fuser assembly oil catch tray and move it back to the oil reservoir. Under most circumstances this action will allow the oil overflow sensor flag to drop back to its normal operating position.

## **Push Down The Floating Oil Overflow Sensor Flag To Reset The Error**

To insure that the previous error condition is cleared, use a finger or other blunt object to gently push the oil overflow sensor flag down to its normal position. The sensor flag floats on top of the oil in the fuser oil catch tray beneath the PS10 photosensor. To access it, open the fuser delivery door so that the PS10 photosensor mounting bracket is exposed. The sensor flag is located behind the mounting bracket (see Figure 5). This step may not be necessary in all cases.

Caution: Allow adequate time for the fuser assembly to cool before performing this procedure.

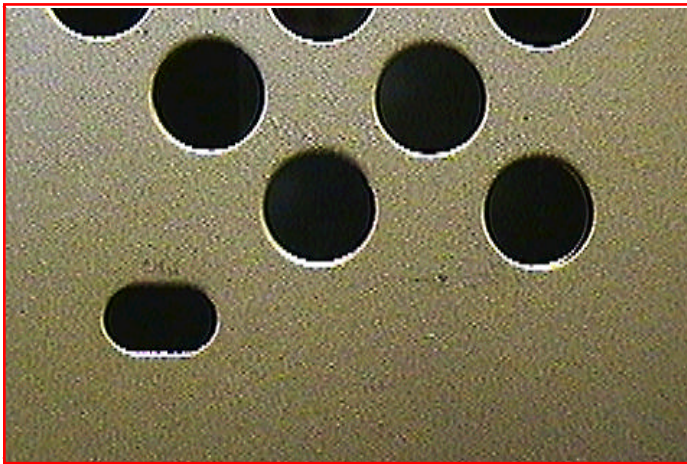


**Figure 5- PS10 Sensor Flag Location**

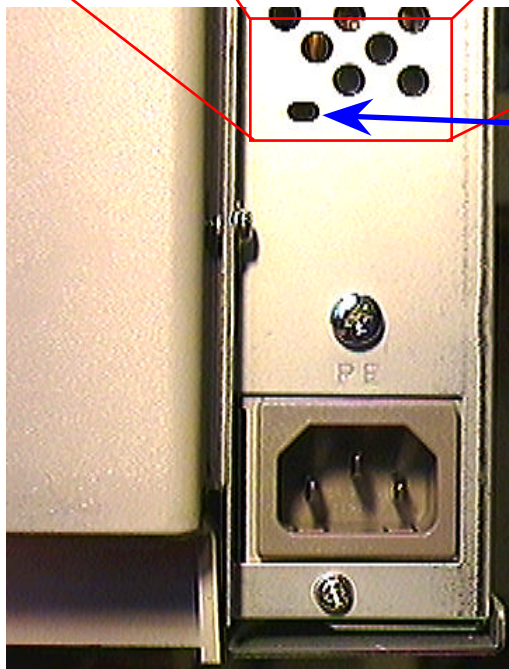
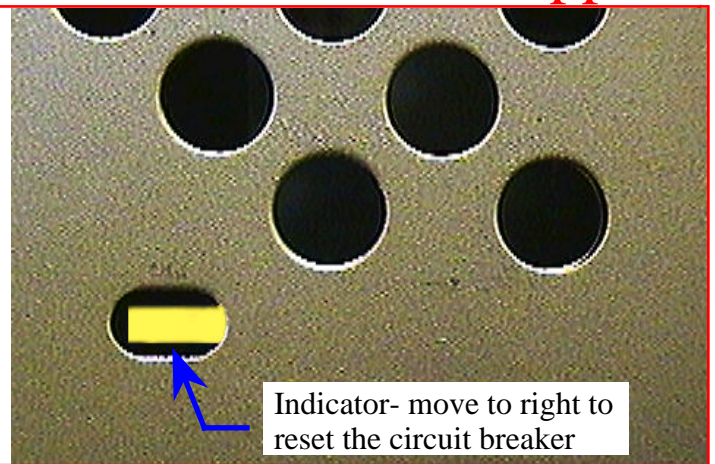
# Color LaserWriter 12/600PS- Circuit Breaker Reset Procedures

In order to access the circuit breaker the rear plastic cover must be removed so that the main power supply is exposed. The circuit breaker itself is hidden, but there is a small oval hole cut in the power supply sheet metal which can be used to view whether or not the circuit breaker needs to be reset. Once the hole has been located (see pictures below), check to see whether or not the yellow plastic indicator from the circuit breaker is visible. If it is visible then the circuit breaker needs to be reset using the procedures listed below.

## Circuit Breaker- Normal



## Circuit Breaker- Tripped



Circuit Breaker Access Hole

### Procedure:

- 1) Remove the rear plastic cover to expose the main power supply.
- 2) Use a small non-conductive wood or plastic probe (i.e. toothpick, ball point pen cap) to gently move the yellow plastic circuit breaker indicator to the right until it is no longer visible.
- 3) Reinstall the plastic covers and test the printer. If the printer continues to trip the circuit breaker then an overload condition still exists. Consult the Service Source troubleshooting documentation for additional assistance.



## Exploded View

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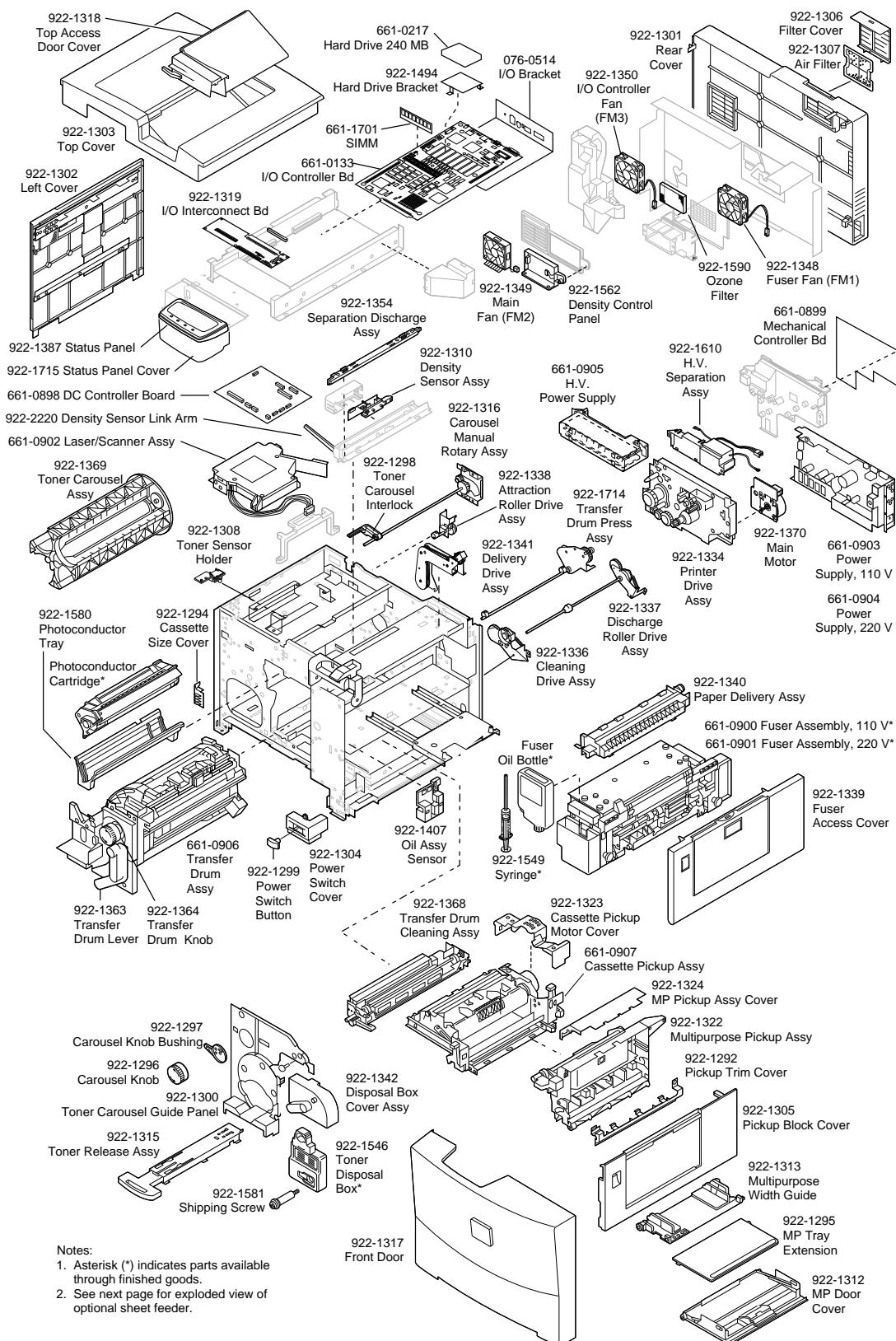
Color LaserWriter 12/600  
12/660







## Exploded View



## Notes:

1. Asterisk (\*) indicates parts available through finished goods.
2. See next page for exploded view of optional sheet feeder.

