This chapter presents an overview of the major components of the printer, and includes a detailed discussion of the image-formation system.

- Basic operation
- Engine control system
- Laser/scanner system
- Image-formation system
- Pickup-and-feed system
Basic operation

Major product systems

The product includes the following systems:

- Engine control system
- Laser/scanner system
- Image-formation system
- Pickup-and-feed system

Figure 5-1 Product systems
Product components

Figure 5-2  Product components

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuser unit</td>
<td>8</td>
<td>Intermediate transfer belt (ITB)</td>
</tr>
<tr>
<td>2</td>
<td>Delivery roller</td>
<td>9</td>
<td>Pickup roller</td>
</tr>
<tr>
<td>3</td>
<td>Print cartridge</td>
<td>10</td>
<td>Separation roller</td>
</tr>
<tr>
<td>4</td>
<td>Laser/scanner unit</td>
<td>11</td>
<td>Registration roller</td>
</tr>
<tr>
<td>5</td>
<td>Photosensitive drum</td>
<td>12</td>
<td>Secondary transfer roller</td>
</tr>
<tr>
<td>6</td>
<td>Priority slot media-feed roller (HP Color LaserJet CP1510 Series Printer only)</td>
<td>13</td>
<td>Fusing film</td>
</tr>
<tr>
<td>7</td>
<td>Primary transfer pad</td>
<td>14</td>
<td>Pressure roller</td>
</tr>
</tbody>
</table>
## Sequence of operation

<table>
<thead>
<tr>
<th>Period</th>
<th>Duration</th>
<th>Purpose</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAIT</td>
<td>From the time the power is turned on or the door is closed until the drum-phase adjustment is complete</td>
<td>Clears the potential from the drum surface, adjusts the drum phase, and cleans the ETB</td>
<td>Detects the toner level, cartridge presence, and environment; completes any required calibration (color registration control and image stability)</td>
</tr>
<tr>
<td>STBY (Standby period)</td>
<td>From end of the WAIT or LSTR period until either the print command is received from the formatter or the power is turned off</td>
<td>Maintains the printer in readiness for a print command</td>
<td>The printer enters sleep mode when the formatter sends a sleep command, and performs color registration and the image stability control when the formatter sends those commands.</td>
</tr>
<tr>
<td>INTR (Initial rotation)</td>
<td>From the time the print command is received until the media is picked up</td>
<td>Prepares the photosensitive drum for printing</td>
<td></td>
</tr>
<tr>
<td>PRINT</td>
<td>From the end of INTR period until the fuser paper sensor detects the trailing edge of paper</td>
<td>Forms the images on the photosensitive drum and transfers the toner image to the print media</td>
<td>Performs image stabilization at a specified print interval or at specified times</td>
</tr>
<tr>
<td>LSTR (Last rotation)</td>
<td>From the end of the PRINT period until the delivery motor stops rotating</td>
<td>Moves the printed sheet out of the printer</td>
<td>The printer enters the INTR period as soon as the formatter sends another print command.</td>
</tr>
</tbody>
</table>
Engine control system

The engine control system coordinates all printer functions and drives the other three systems.

The engine control system contains the DC controller, high-voltage power-supply PCA, and low-voltage power-supply unit.

Figure 5-3  Engine control system components

Formatter

ENGINE CONTROL SYSTEM

DC controller

High-voltage power supply

Low-voltage power supply/
Fuser power supply

LASER/SCANNER SYSTEM

IMAGE-FORMATION SYSTEM

PICKUP-AND-FEED SYSTEM
DC controller

Figure 5-4 DC controller circuit diagram

- AC input
- Fuser unit
- Fuser power supply
- Low-voltage power supply
- Cartridge
- High-voltage power supply
- Formatter
- Sensor
- Laser/scanner unit
- Motor
- Solenoid
- Switch
- Sensor
- ITB unit
Low-voltage power supply

Figure 5-5  Low-voltage power supply

AC input

Fuse FU901

Power switch SW801

Fuse FU801

Noise filter

Fuser control circuit

DC controller

Fuser power supply

Frequency detection circuit

Protection circuit

Low-voltage power supply

Rectifying circuit

Only for the 200V model

+24V generation circuit

+3.3V generation circuit

REM24V

REM24V

+24V

+3.3V

+3.3V
High-voltage power supply

Figure 5-6  High-voltage power supply

Primary charging high-voltage generation circuit

Developing high-voltage generation circuit

Blade high-voltage generation circuit

Primary charging

High-voltage generation

Development

Blade

Primary transfer pad

ITB cleaning brush high-voltage generation circuit

ITB cleaning roller high-voltage generation circuit

Secondary transfer high-voltage generation circuit

Primary transfer high-voltage generation circuit

Primary transfer pad

Secondary transfer roller

ITB cleaning unit

ITB cleaning brush

ITB cleaning roller

Secondary transfer roller

Primary transfer roller

DC controller
**Laser/scanner system**

The formatter sends video signals to the DC controller, which controls the laser/scanner. When the laser/scanner system receives those signals, it converts them to latent images on the photosensitive drum.

**Figure 5-7 Laser/scanner system**

![Diagram of laser/scanner system]

**Laser failure detection**

The optical unit failure detection sensor manages the laser/scanner unit failure-detection functions. The DC controller identifies the laser/scanner unit failure and notifies the formatter if the laser/scanner unit encounters the following conditions:

- Scanner motor failure
- BD failure
Image-formation system

The image-formation system forms a toner image on media. The product includes four print cartridges that contain the toner. Toner is applied in the following order, using only the colors necessary for a specific image: yellow (Y), magenta (M), cyan (C), and black (Bk).

![Image-formation system diagram](image)

**Figure 5-8** Image-formation system

Image-formation process

Laser printing requires the interaction of several different technologies including electronics, optics, and electrographics to provide a printed page. Each process functions independently and must be coordinated with the other processes. Image formation consists of the following processes:

- Latent-image formation
- Development
- Transfer
- Fuser
- ITB cleaning
- Drum cleaning
These processes are divided into nine steps, which are shown in Figure 5-9 Image-formation process on page 81 and described in the following sections.

**Figure 5-9 Image-formation process**

![Image-formation process diagram]

**Latent-image formation stage**

During the three steps that comprise this stage, a latent image is formed by applying a negative charge to the photosensitive drum. You cannot see this image on the drum.

**Step 1: primary charging**

A high-voltage DC bias is applied to the primary charging roller, which is made of conductive rubber and is in contact with the drum surface. As the roller moves across the drum, it applies the negative charge to that surface.

**Figure 5-10 Primary charging**

Primary charging roller
Step 2: laser-beam exposure

The laser beam scans the photosensitive drum to neutralize the negative charge on portions of the drum surface. An electrostatic latent image is formed where the negative charge was neutralized.

Figure 5-11 Laser-beam exposure

Developing stage

The developing cylinder comes in contact with the photosensitive drum and deposits toner on the electrostatic latent image.

Step 3: development

Toner acquires a negative charge as a result of the friction from the developing cylinder rotating against the developing blade. When the negatively charged toner comes in contact with the drum, it adheres to the electrostatic latent image. When the toner is on the drum, the image becomes visible.
Transfer stage

Step 4: primary transfer

The toner image on the photosensitive drum is transferred to the ITB. The DC positive bias is applied to the primary transfer pad. The negatively charged toner transfers to the ITB from the drum surface.

Figure 5-13 Primary transfer

Step 5: secondary transfer

The toner image on the ITB is transferred to the print media. The DC positive bias is applied to the secondary transfer roller. As the media passes between the secondary transfer roller and the ITB, the toner image is transferred to the media.

Figure 5-14 Secondary transfer
**Step 6: separation from the drum**

The elasticity of the print media and the curvature of the ITB drive roller cause the media to separate from the ITB.

![Figure 5-15 Separation from the drum](image)

**Fusing stage**

Until the fusing stage is complete, the image is not permanently affixed to the print media. The toner can be easily smudged until the heat and pressure of the fusing process fix the image to the sheet.

**Step 7: fusing**

The product uses an on-demand fixing method to fix the toner image onto the media. The toner image is permanently affixed to the print media by the heat and pressure.

![Figure 5-16 Fusing](image)
ITB cleaning stage

Step 8: ITB cleaning

The ITB cleaning roller and the cleaning brush are applied with the DC positive bias to charge the residual toner positive. Because the primary transfer pad is also applied with the DC positive bias, the positively charged residual toner is reverse-transferred to the photosensitive drum from the ITB surface.

Figure 5-17 ITB cleaning

- Positive potential waste toner
- Negative potential waste toner
Drum cleaning stage

Not all of the toner is removed from the photosensitive drum during the transfer stage. During the cleaning stage, the residual, or waste, toner is cleared from the drum surface to prepare the surface for the next latent-image formation.

Step 9: drum cleaning

The cleaning blade scrapes the residual toner off the surface of the photosensitive drum and deposits it in the waste-toner container. The drum is now clear, and is ready for the next image-formation process.

Figure 5-18 Drum cleaning
Pickup-and-feed system

The pickup-and-feed system picks up and feeds the print media. It consists of several types of feed rollers.

**Figure 5-19  Pickup-and-feed system**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M701</td>
<td>Main motor</td>
</tr>
<tr>
<td>M702</td>
<td>Pickup motor</td>
</tr>
<tr>
<td>M703</td>
<td>Fuser motor</td>
</tr>
<tr>
<td>SL705</td>
<td>Cassette pickup solenoid</td>
</tr>
<tr>
<td>SR601</td>
<td>Cassette media-presence sensor</td>
</tr>
<tr>
<td>SR602</td>
<td>Top-of-page sensor</td>
</tr>
<tr>
<td>SR603</td>
<td>Loop sensor</td>
</tr>
<tr>
<td>SR604</td>
<td>Priority slot media-presence sensor (HP Color LaserJet CP1510 only)</td>
</tr>
<tr>
<td>SR605</td>
<td>Priority slot top-of-page sensor (HP Color LaserJet CP1510 only)</td>
</tr>
<tr>
<td>SR609</td>
<td>Fuser delivery sensor</td>
</tr>
</tbody>
</table>

**HP Color LaserJet CP1510 only**
Jam detection

The product uses the following sensors to detect the presence of media and to check whether media is being fed correctly or has jammed:

- Cassette media-presence sensor
- Top-of-page sensor
- Loop sensor
- Priority slot media-presence sensor (HP Color LaserJet CP1510 only)
- Priority slot top-of-page sensor (HP Color LaserJet CP1510 only)
- Fuser delivery sensor

The product detects the following jams:

- Pickup delay jam
- Pickup stationary jam
- Delivery delay jam
- Delivery stationary jam
- Fixing wrapping jam
- Residual media jam