RICOH

Model BL-P1
(M087/M088)
Service Training

Draft started: 9 November 2010

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Corrections applied to slide 17: 6 January 2011

Course Contents

- A note to the training supervisor -

This course was written assuming the following requirements. Modify as necessary depending on your situation.

- ❑ Preparation
  - Prior to starting this course, prepare the following items. -
  - ➢ Training machines – M088 (BL-P1a) and M087 (BL-P1b) in the shipping boxes
  - ➢ A set of service tools
  - ➢ The BL-F1 Field Service Manual
  - ➢ The M088 (BL-P1a) and M087 (BL-P1b) User's Manuals
- ❑ Requirements for trainees
  - ➢ Prior to starting this course, the following training or equivalent should be completed.

    Fax basics course

    Copier basics course
  - ➢ The trainee should also be familiar with the Core Technology Manual and be able to reference it during training.
- ❑ Time required to complete this course: 6 hours or less.

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Model BL-P1
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1. Product Outline

No additional notes.

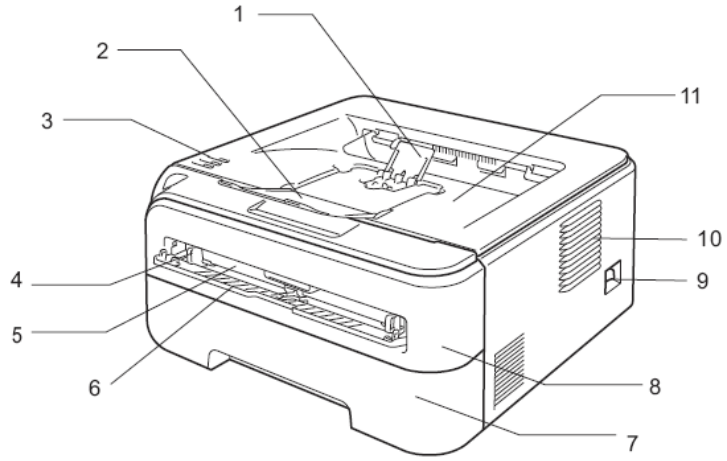
Appearance

BL-P1
(M087/M088)

- **This is the machine you will study in this training course.**
- **The two models are externally the same.**

- The BL-P1b (M087) has NIC and USB2.0 interfaces but the BL-P1a (M088) does not.
- The BL-P1a (M088) will be marketed in China only.
- The BL-P1b (M087) will be marketed in the Americas, Europe, and Asia/Oceania (but not China).

External Components – Front

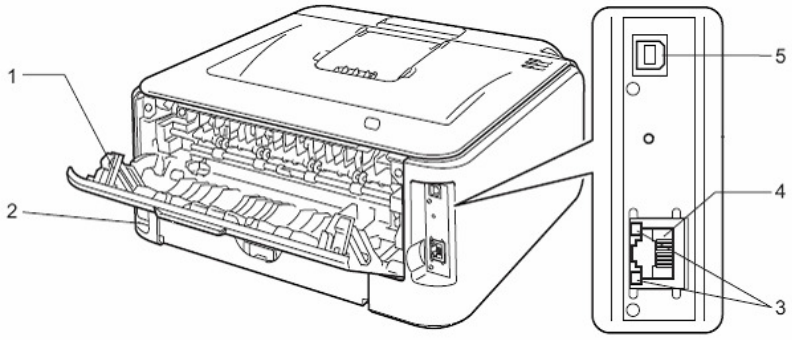


1. Face-down output tray support flap 2	7. Paper tray
2. Face-down output tray support flap 1	8. Front cover
3. Control panel	9. Power switch
4. Manual feed paper guide	10. Ventilation grid
5. Manual feed slot	11. Face down output tray
6. Manual feed slot cover	

- See the Quick Start Guide for a list of components in the shipping carton.

- Refer to the operating instructions for more details.

External Components – Rear

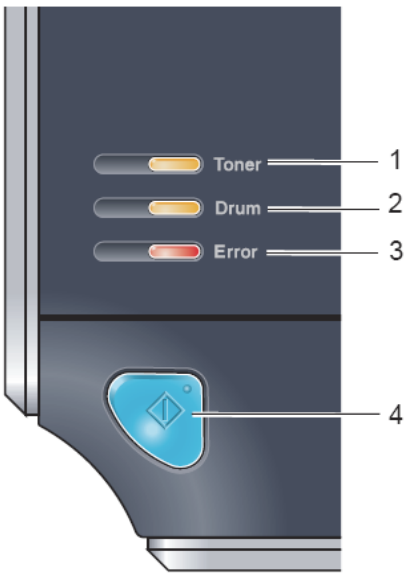


1. Back cover (back output tray)	4. 10/100BASE-TX port*
2. AC power connector	5. USB connector
3. Network status LEDs*	

*BL-P1b (M087) only

No additional notes.

Control Panel



1. **Toner LED**
   The Toner LED indicates when the Toner is low or at the end of its life.
2. **Drum LED**
   The Drum LED indicates when the Drum is nearing the end of its life.
3. **Error LED**
   The Error LED indicates when the printer is in one of the following states:
   No paper / Paper jam / Cover open
4. **Ready LED**
   The Ready LED will flash depending on the printer status.

   Go button
   Wake-up / Error recovery / Form feed / Job Cancel / Reprint

❑ **Refer to the User's Guide for details of how these LEDs and the Go button are used.**

No additional notes.

Market Positioning and Concept

- **Main Objective**
  - Maintain and expand MIF in the low end market
- **Target Users**
  - Business personal (1 to 4 users)
  - Small office (5 to 29 users)
  - Can double as a small office printer/copier
- **Key sales points**
  - Small, stable, and convenient laser printer
  - Low TCO*
  - Low environmental impact (ECO friendly)
- **Features**
  - Easy management (uses universal driver)
  - Integrated PCL/PS
  - Small size (especially low height)

- *TCO = Total cost of ownership

Reliability Targets

- **Toner yield**
  - Starter toner: Approximately 1,000 sheets
  - Toner: Approximately 2,600 sheets
    (Approximate toner yield calculations based on the ISO/IEC 19752 standard.)
- **Drum yield: Approximately 12,000 sheets**
- **Expected product life: 5 years or 50K prints**

No additional notes.

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2. Specifications

No additional notes.

General Specifications

- **Resolution: 300 dpi, 600 dpi, 2400 x 600 dpi**
- **Print speed: 22 ppm (A4), 23 ppm (8½" x 11")**
- **First copy time: Less than 10 seconds**
- **Paper tray capacity: 250 sheets**
- **By-pass tray capacity: 1 sheet**
- **Paper weight**
  - Cassette: 60 – 105 g/m^2, 16 – 28 lb
  - Bypass: 60 – 163 g/m^2, 16 – 43 lb
- **Warm up time: Less than 18 s (23°C)**

- This slide shows the basic specifications.
- For more detailed specifications, see the field service manual.

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3. Installation

No additional notes.

Overview

- **Generally, the user installs this machine. However, in addition to your maintenance duties, you may also have to install the machine when you are in the field.**
- **The full installation procedure is in the *Setting Up the Machine* section of the *Quick Setup Guide*.**
- **Before you start installation:**
  - Check the accessories.
  - Confirm the location to install the machine.

No additional notes.

Install the Machine

- **The following are the main steps to installation. Refer to the Quick Setup Guide (QSG) for details.**
  - Install the drum unit.
  - Load paper in the paper tray.
  - Connect the power cord.
  - Do a test print.
- **In addition to the above, the user may ask you to set up their computer for printing. (Refer to the QSG.)**

- The *User's Guide* contains a lot more information about machine setup options. Familiarize yourself with it in case the user requests your help.

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4. Machine Overview

No additional notes.

Component Layout

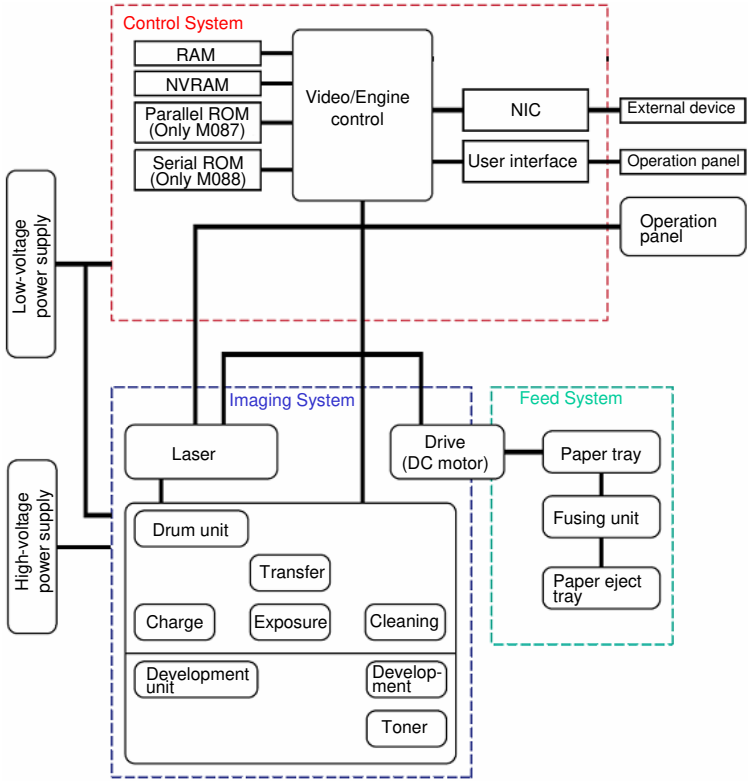
❑ **Main print engine components viewed in cross-section. (The name table is in the notes. Use Notes Page view.)**

❑ Familiarize yourself with the main components.

1. Laser unit	15. Pressure roller
2. Supply roller	16. Heat roller
3. Development roller	17. Bottom plate
4. Transfer roller	18. Registration rear actuator
5. Drum	19. Paper feed roller
6. Paper stack lever	20. Separation roller
7. Eject roller 2	21. Separation pad
8. Pinch roller	22. Separation pad assembly
9. Back cover	23. Edge actuator
10. Fuser unit	24. Paper tray
11. Eject roller 1	25. Front feed roller
12. Outer chute	26. Registration front actuator
13. Fuser cover	27. Manual feed slot cover
14. Eject actuator	28. Registration roller

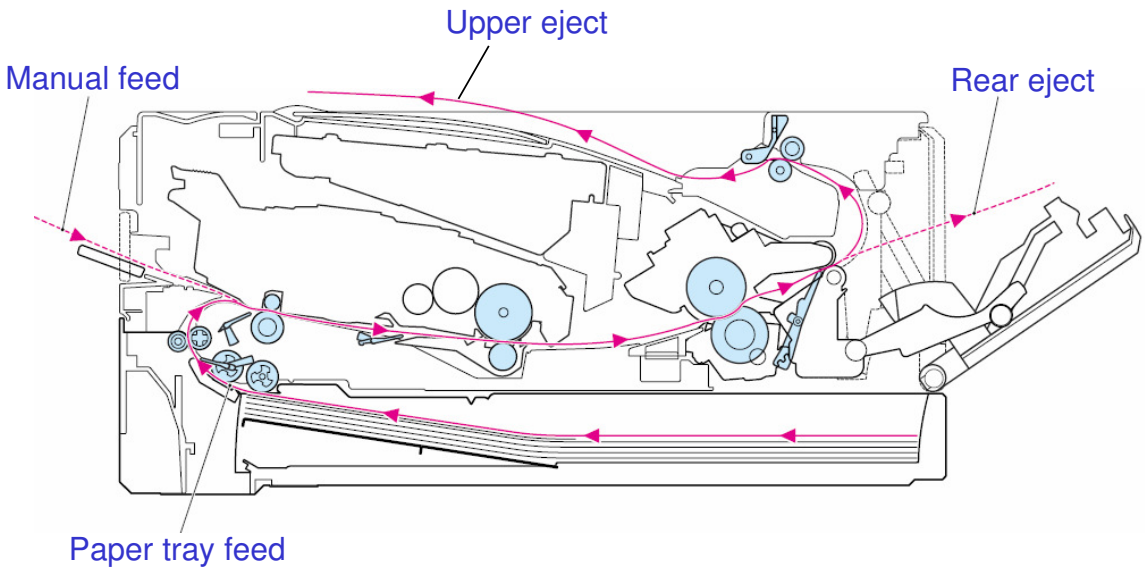
Overall Control

- The chart shows the overall control flow within the machine.



No additional notes.

Paper Path



- **The red lines show the paths the paper takes through the machine.**

No additional notes.

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5. Service Maintenance
(Maintenance Mode, Cleaning)

No additional notes.

Entering Maintenance Modes

❑ Entering User Mode

- Basically used for service maintenance but it may be disclosed to users if necessary.
- To enter User Mode:
  1. Turn off the power and confirm that the front cover is closed.
  2. Turn on the power while pressing the Go button.
  3. When the Drum and Error LEDs light release the Go button.

Go Button

❑ For details about entering service maintenance mode, ask your supervisor.

No additional notes.

User Maintenance Mode

- After entering User Mode, press the Go button from 1 to 8 times to select a maintenance function or mode as shown by the following table.
- Refer to the FSM for details about the individual functions or modes.

Press Go Button	Resulting Function/Mode
Once	1) Test Sample Page
Twice	2) Print Fonts
Three times	3) USB 2.0 FULL Serial Number Return Value Setting
Four times	4) Hex Dump Mode
Five times	5) PCB Only Mode
Six times	6) 1 Push Printing Recovery Mode*
Seven times	7) Network Reset 1 (APIPA: ON)*
Eight times	8) NV-RAM Factory Reset*
Nine (or more) times	1) Test Sample Page (same as pressing once)

*All LEDs should light for one second.

No additional notes.

Service Maintenance Mode – 1

- **After entering Service Mode, press the SW supporter once to select service mode set 1 (table below).**
  - Confirm that the Toner, Drum, and Error LEDs light.
- **Press the SW supporter from 1 to 7 times to select a maintenance function or mode as shown by the following table.**

Service Mode Set 1

Press SW Supporter	Resulting Function/Mode
Once	9) Factory Inspection Mode
Twice	10) Continuous Grid Pattern Print Mode
Three times	11) Fixing Unit Test Print
Four times	12) NV-RAM Value Dump Mode
Five times	13) RAM Check
Six times	14) QA Test Print
Seven times	15) Paper Size Setting (A4/Letter)
Eight times or more	Back to normal state

- **Refer to the FSM for details about the individual functions or modes.**

No additional notes.

Service Maintenance Mode – 2

- After entering Service Mode, press the SW supporter twice to select service mode set 2 (table below).
  - Confirm that the Toner, Drum, and Error LEDs light.
- Press the SW supporter from 1 to 5 or 7 times to select a maintenance function or mode as shown by the following table.

Service Mode Set 2

Press SW Supporter	Resulting Function/Mode
Once	16) Printing for Maintenance
Twice	17) Printer Settings
Three times	18) Sleep Mode Indication (Off/Dimmed)
Four times	19) Sleep Mode Setting (Off/On)*
Five times	20) Developer Roller Counter Reset 1 (For starter toner cartridge)*
Six times	Not used (Do not select, will cause counter error.)
Seven times	21) Developer Roller Counter Reset 2 (For standard toner cartridge)*
Eight times or more	Back to normal state

*All LEDs should light for one second.

- Refer to the FSM for details about the individual functions or modes.

No additional notes.

Resetting the Drum Counter

- **When the drum unit is replaced, the drum counter must be reset.**
- **Refer to the FSM or the User's Guide for the procedure and for other details.**
  - FSM → Service Maintenance → Other Service functions → Resetting the Drum Counter
    Or:
  - User's Guide → Routine Maintenance → Drum Unit

No additional notes.

Initializing the Developer Bias

- **A new toner cartridge is detected by the new toner sensor and developer bias is initialized automatically.**
- **If a previously installed toner cartridge (containing sufficient toner) is installed, you must force development bias initialization.**
- **Refer to the FSM for the procedure and for other details.**
  - FSM → Service Maintenance → Other Service functions → Initializing the Developer Bias

- If the developer bias is not initialized, print density may be too light.

Cleaning

- **This machine designed for user maintenance; so, it does not have a periodic maintenance schedule.**
- **As a preventive maintenance measure, you may need to clean machine components during service calls.**
- **Go to the machine and practice cleaning procedures.**
  - Pay particular attention to cleaning the drum.
  - Refer to the User's Guide for the cleaning procedures.
  - Pay particular attention to important notes and cautions.

No additional notes.

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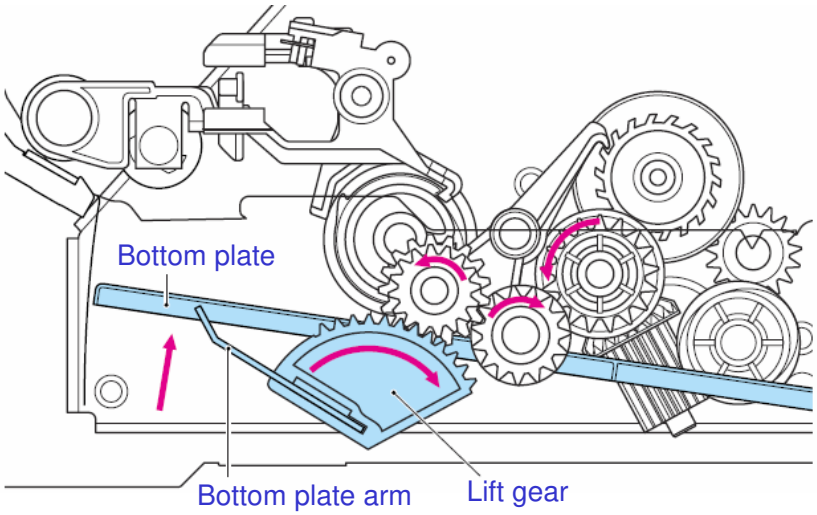
6. Mechanical Operation

No additional notes.

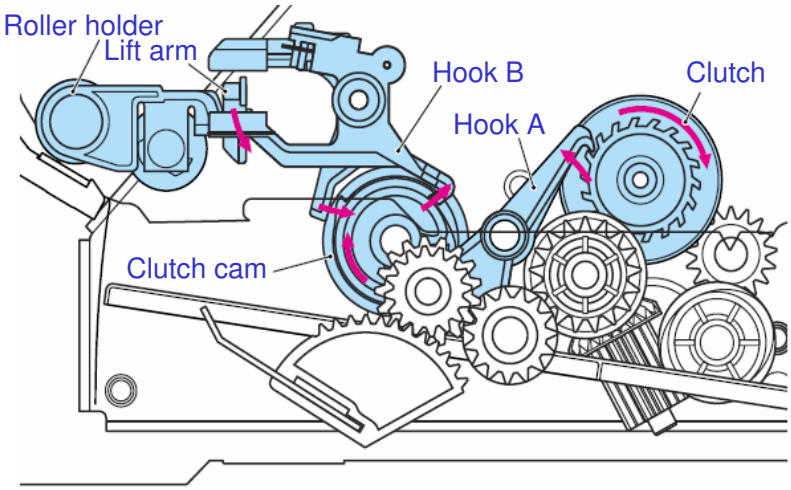
Paper Lift 1



- The bottom plate of the paper tray is pushed up by the main motor (not by springs).
- The pressure is kept constant to optimize paper-feeding performance irrespective of the quantity of paper remaining in the tray.
- After paper is inserted, the main motor drives the lift gear by way of several gears. The bottom plate arm raises the bottom plate.

No additional notes

Paper Lift 2

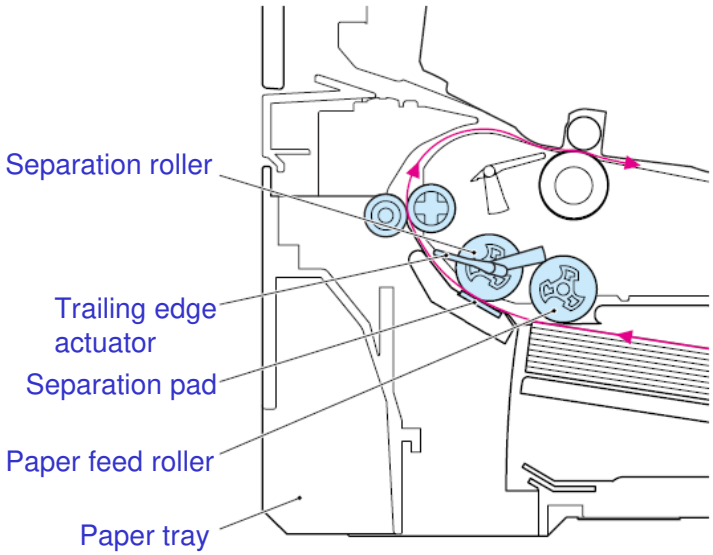


- When paper reaches the feed position, the roller holder goes up. Then the lift arm goes down and hook B is released. The clutch cam released by hook B rotates to push down the rib of the hook A. Hook A releases the ratchet of the clutch and the bottom plate lift arm stops its push-up function.
- Confirm the operation of this mechanism on the machine.

No additional notes

Paper Feed

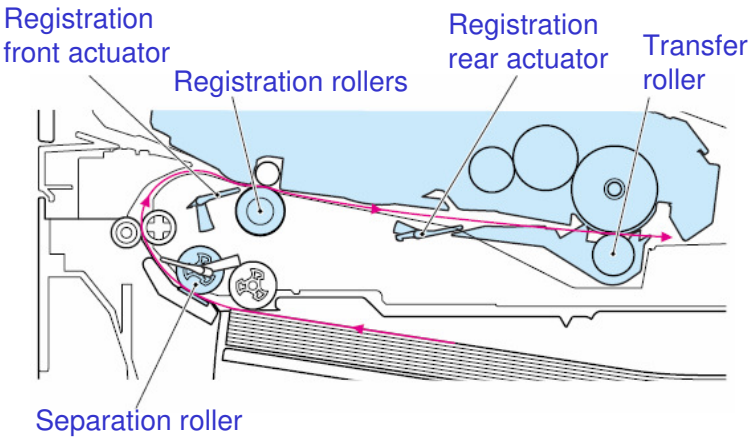
- **The feed roller moves paper to the separation pad and separation roller.**
- **The separation roller turns to feed paper to the separation roller.**
- **The separation pad strips off the top sheet.**
- **The trailing edge actuator is for misfeed detection.**



- This is a typical friction pad feed system. (In this machine the friction pad is called a separation pad.) For a general discussion of the *friction pad* feed system, see the Core Technology Manual.

Paper Registration

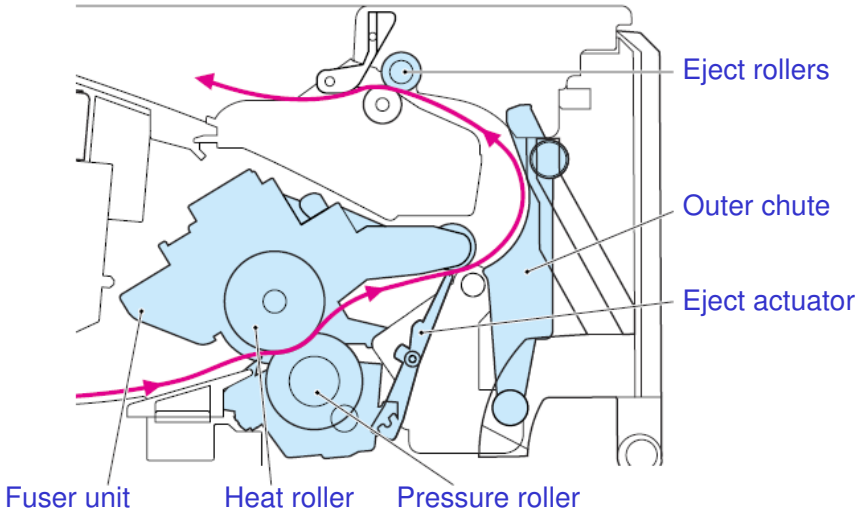
- The registration front actuator detects the leading edge of the paper.
- The leading edge of the paper then contacts the registration rollers, which are not turning at that time, and buckles slightly, correcting skew.
- After skew correction, the registration rollers start turning and the paper is carried to the transfer roller.



Function of Actuators

- The registration front actuator detects the front-edge of paper, and sets the start timing for registration roller drive. It also detects the passage of paper (jam detection).
- The registration rear actuator sets the start timing for writing the image to the drum (image registration). It also detects the passage of paper (jam detection).

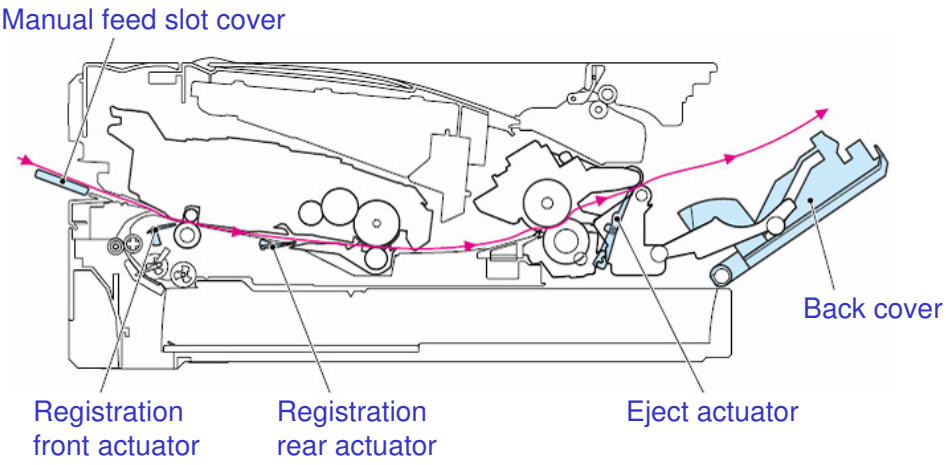
Image Fusing and Paper Ejection



- Toner is fused to the paper by the heat roller and pressure roller of the fuser unit.
- Paper moves along the outer chute and is ejected face-down into the output tray by the eject rollers.
- The eject actuator detects whether or not paper is ejected from the fuser unit (jam detection). When a paper jam is detected near the eject actuator, the main motor reverses to disengage the gears. The eject rollers become free, allowing the paper jam to be cleared.

No additional notes.

Manual Feed and Back Ejection



- When manual feeding, one sheet of paper is inserted through the manual feed slot. The registration front actuator detects the paper, and shortly after that the registration rollers start turning to feed the paper.
- When printing with the back cover open, the paper is ejected onto the back cover with its print side up.

No additional notes.

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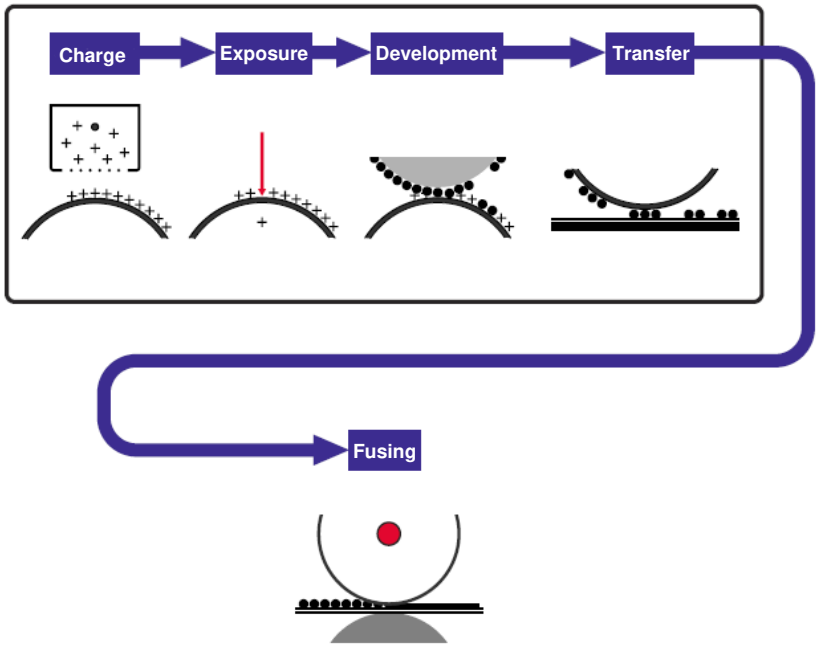
7. Print Processes

No additional notes.

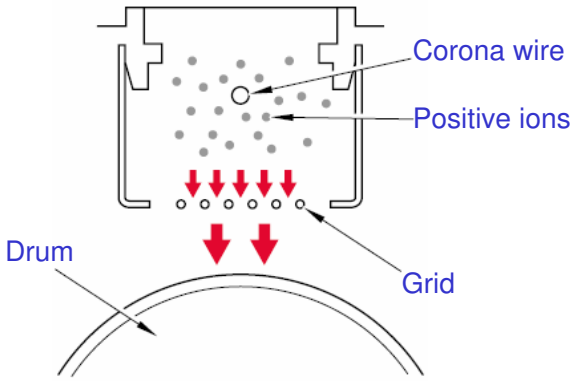
Print Processes 1 – Overview



- Printing is done by the five processes shown above

No additional notes.

Print Processes 2 – Charge

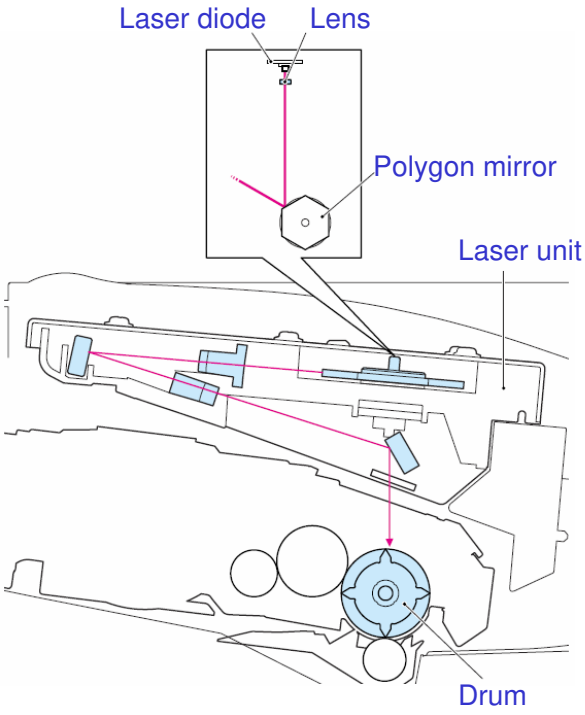


- **Corona charges the surface of the drum to +850 V.**
- **Grid ensures an even charge distribution.**
- **Aluminum sleeve of the drum is grounded, providing a path for the charge to go to ground upon exposure to light.**

- The level of ozone expelled from the machine is less than 3.0 mg/h and therefore is not harmful to the human body.

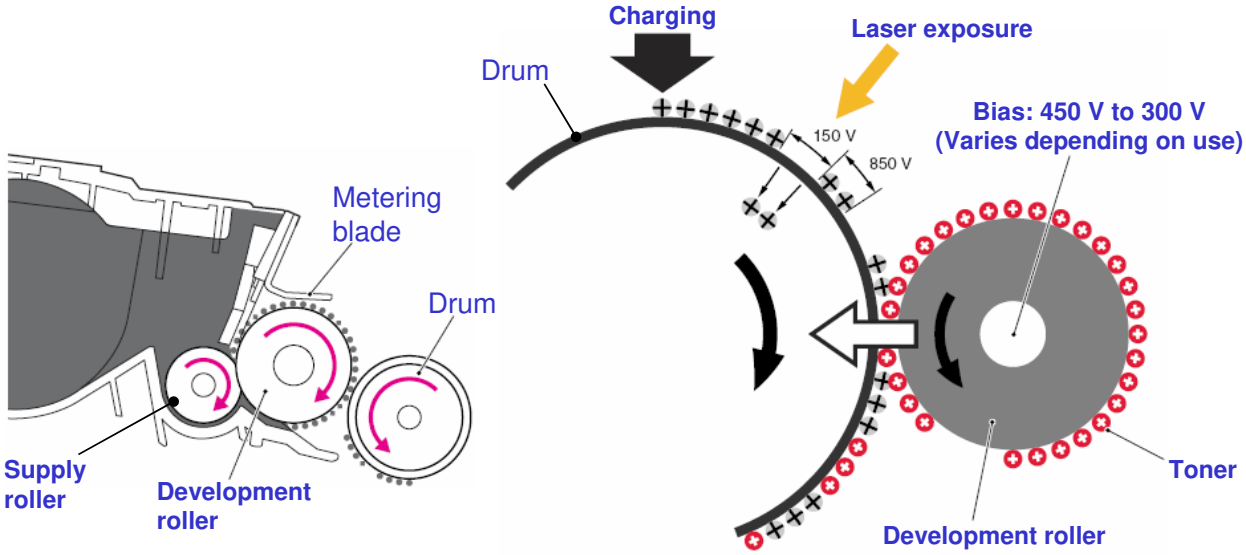
Print Processes 3 – Laser Exposure

- **A latent image is formed on the positively charged drum by light from the laser unit.**
- **Where light strikes, the resistance of the OPC layer drops and the charge on the drum surface goes through the aluminum core to ground.**



- Refer to the Core Technology Manual for more information about laser printing systems.

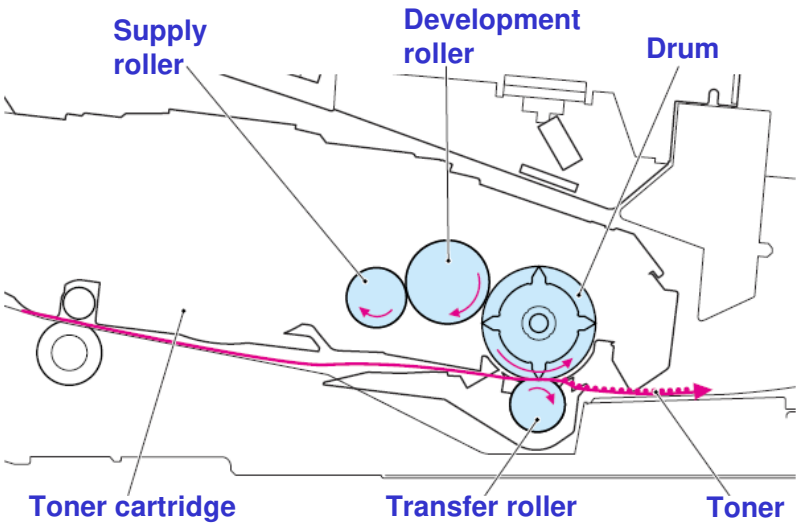
Print Processes 4 – Development



- **Supply roller applies toner to the development roller.**
- **Metering blade controls the thickness of the layer of toner on the development roller.**
- **Toner is attracted to the latent image areas, thereby developing the image.**

- Toner is non-magnetic. It gets a triboelectric positive charge from the rotation of the supply roller and development roller.
- The electrostatic potential between the development roller and the OPC drum causes the toner to be attracted to the latent image areas on the drum surface.

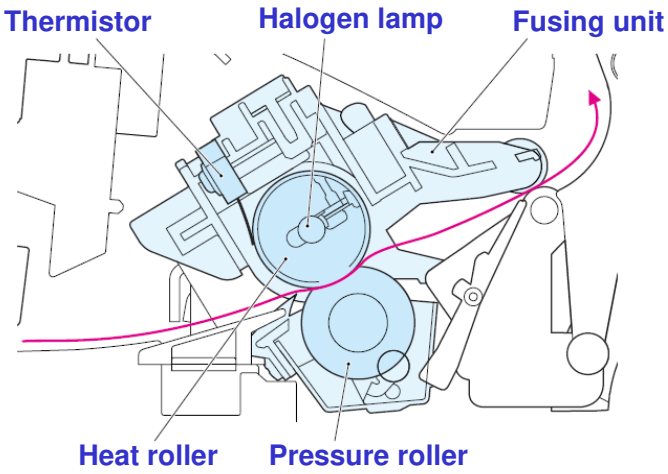
Print Processes 5 – Image Transfer



- The negatively charged transfer roller attracts the toner from the drum to the paper.
- The negative bias applied in the transfer roller is adjusted according to types and sizes of paper so as to keep consistent image quality.

No additional notes.

Print Processes 6 – Fusing



- The image is fixed to the paper by heat and pressure as the paper passes through the fusing unit.
- A thermistor monitors the heat roller temperature and the halogen lamp turns on/off to maintain a constant heat roller temperature.

No additional notes.

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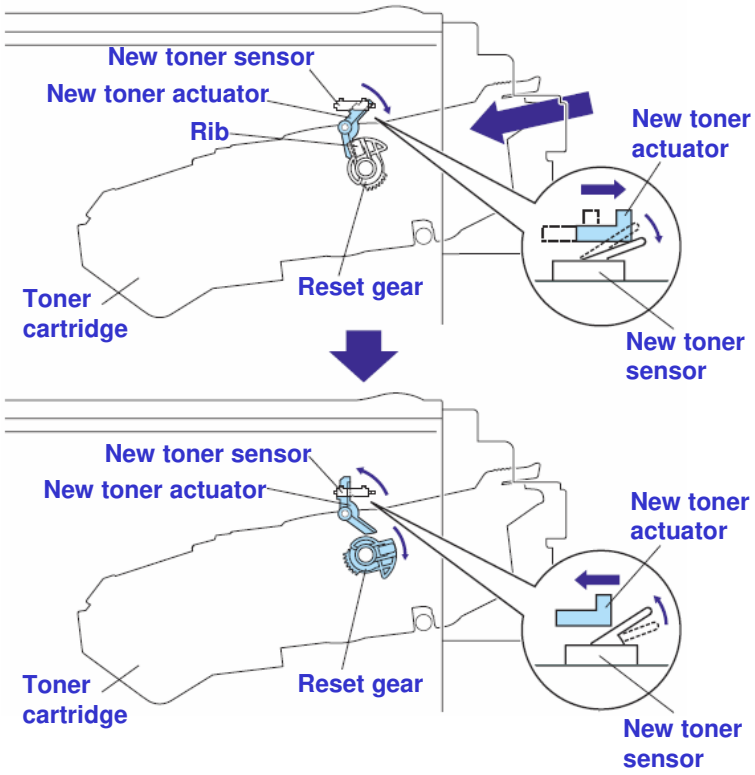
8. Toner Cartridge

No additional notes.

New Toner Cartridge Detection

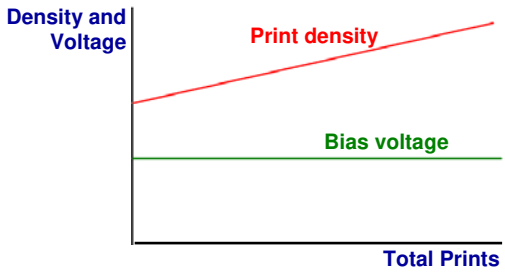
- When a new toner cartridge is installed, the rib on the reset gear rotates the new toner actuator and the new toner switch turns on.
- The main motor turns the reset gear to rotate the reset tab clockwise to the down position.
- Print count and development bias are reset.



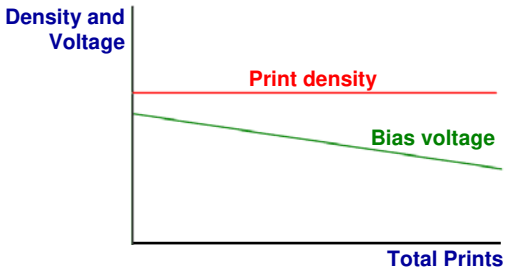
No additional notes.

Development Bias Control

<Toner Properties>



<Actual Bias Control>



- **Toner properties change over the course of usage.**
- **With constant bias, the print density would slowly increase.**
- **To maintain constant print density, the bias voltage is gradually decreased based on print count.**

- When the new toner sensor detects a new toner cartridge, the development bias is set to +450V.
- Over time the toner particles become more strongly charged; so, the development bias is stepped down according to the number of prints.

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9. Replacement and Adjustment

No additional notes.

Before You Start

❑ Safety Precautions

- It is important to observe the all safety precautions during maintenance work.
- Refer to the list of safety precautions in the field service manual.
  - » FSM → Replacement and Adjustment → Safety Precautions
- Additionally, pay attention to all notes and cautions related to specific procedures elsewhere in the FSM.

No additional notes.

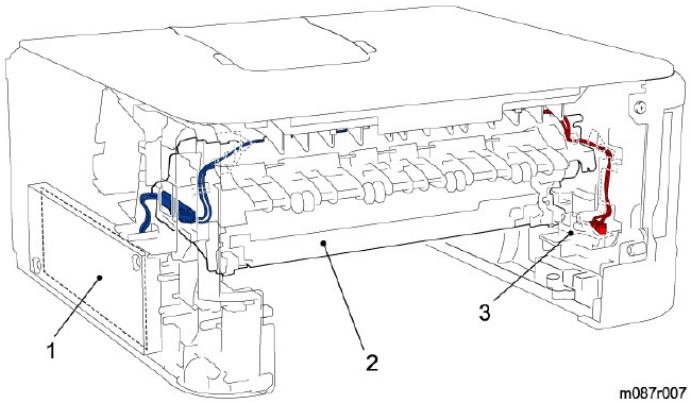
Removing and Replacing Parts

- **Disassembly Flowchart**
  - Refer to the disassembly flowchart in the FSM.
    - » FSM → Replacement and Adjustment → Disassembly Flow
  - The disassembly flowchart shows what components must be removed and the order of removal in order to access target components.
- **Disassembly Practice**
  - Referencing the FSM, go to the machine and practice removing and reinstalling parts.
    - » FSM → Replacement and Adjustment → Disassemble Procedure
  - Observe all notes and cautions.

No additional notes.

Harness Routing

- The "Harness Routing" section of the FSM shows the positioning of harnesses and wires in the machine.
- Refer to it when reassembling the machine.
  - FSM → Replacement and Adjustment → Harness Routing



< Example Harness Routing Diagram >

No additional notes.

Adjustment after Parts Replacement

- **Adjustments and settings changes are required after replacing the following parts.**
  - Main PCB
  - Laser Unit
- **Refer to the FSM for the details.**
  - FSM → Replacement and Adjustment → Adjustments and Updating of Settings, Required After Parts Replacement

No additional notes.

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10. Troubleshooting

No additional notes.

Troubleshooting

- **Troubleshooting Practice:**
  - Study the Troubleshooting sections of the FSM appendix and User's Guide.
  - Simulate some of the error conditions on the machine.

No additional notes.

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11. Technology for Environmental Conservation

- This section explains the technology used in this machine for environmental conservation, and the default settings of related functions.

Technology for Environmental Conservation

**: New or modified function
*: Has this function
Blank: Does not have this function

Environmental Technology/Feature	Description	M087/M088
1. QSU	- Reduction of warm-up time (Energy saving) - Reduction of CO_2 emissions	
2. Hybrid QSU		
3. IH QSU		
4. Paper-saving features	- Allows documentation to be managed digitally, cutting down on paper consumption. - Improves machine productivity when printing out duplex (double-sided) images.	
5. High-speed duplex output	- Improves machine productivity when printing out duplex (double-sided) images	
6. Ozone reduction design	- Low ozone emissions	*
7. PxP (polymerized) toner	-Energy saving - Conservation of materials/resources (reduced toner consumption)	
8. Noise reduction design	- Low noise	*
9. Minimization of harmful substances	- Minimization of harmful substances	*
10. Environmentally-friendly toner bottle	- Conservation of materials/resources	
11. Toner recycling		
12. Recycle-friendly design		*

- This slide explains what technologies are used for conserving the environment in this product.

Brief Descriptions of the Technologies

- **1. QSU (Quick Start-up)**
  - This technology reduces both the amount of energy consumed while in Standby mode (the Ready condition) is reduced, as well as the time it takes for the machine to warm up to the Ready condition.
  - This is made possible through the utilization of dual fusing lamp heating, low fusing point toner, a pressure roller with a "sponge" surface layer, and a thin surface layer hot roller.
- **2. Hybrid QSU**
  - This technology adds an additional circuit to conventional QSU Technology, which allows the benefits of reduced energy consumption and reduced warm-up time described above to be extended to high-speed machines.

No additional notes

Brief Descriptions of the Technologies

- **3. IH QSU**
  - This technology incorporates IH (Inductance Heating) technology into conventional QSU technology, which allows the benefits of reduced energy consumption and reduced warm-up time to be extended to color machines.
- **4. Paper-saving features**
  - 1) The duplex (double-sided) and Combine features reduce paper consumption.
    2) The Document Server and other electronic document management features reduce paper consumption by offering an electronic method for storing and managing important documents.

No additional notes

Brief Descriptions of the Technologies

- **5. High-speed duplex output**
  - 1) Enables high-speed duplex printing through the utilization of the Duplex Interleaf and high-speed Inverter Transport features.
  - 2) Enables quick printing of duplex jobs through the use of Duplex Scanning.
- **6. Ozone reduction design**
  - Greatly reduces the machine's ozone emissions to near-zero levels by utilizing:
    1) A charge roller/belt instead of a corona wire
    2) An image transfer roller/belt instead of a corona wire-based transfer system

No additional notes

Brief Descriptions of the Technologies

- **7. PxP (polymerized) toner**
  - "PxP toner" is a fine-particle, polyester resin based toner, manufactured using a Ricoh-original polymerization method instead of the conventional pulverization method.
  - This allows the toner to fuse at a lower temperature, which reduces the impact on the environment and contributes to achieving even higher image quality than before.
  - PxP toner also has other benefits, including a reduction in the amount of toner needed to develop the image, as well as an approximate 35% reduction in CO_2 emissions during the toner manufacturing process.

No additional notes

Brief Descriptions of the Technologies

- **8. Noise reduction design**
  - 1) The machine and its components are designed to minimize the overall noise generated by the machine. As a result, all noise levels conform to the local laws and regulations as well as user requirements in each market in which the products are sold.
  - 2) Reduces the noise generated by the polygon mirror motor.
- **9. Minimization of harmful substances**
  - 1) Products sold in the EU conform to the RoHS Directive.
  - 2) Products sold in China conform to China's version of the RoHS Directive.
  - 3) In addition, Ricoh imposes strict internal standards for limiting the presence of harmful substances.

No additional notes

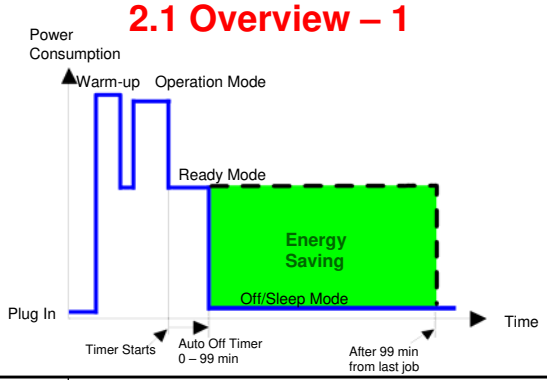
Brief Descriptions of the Technologies

- **10. Environmentally-friendly toner bottle**
  - A changeover from PS/PP/HDP to PET plastics allows approximately 40 percent by weight of the toner bottle to be recycled, and also reduces CO_2 emissions that occur during the toner bottle manufacturing process.
- **11. Toner recycling**
  - Enables effective use of resources by recycling (reusing) the toner left over on the drum surface after image transfer.
- **12. Recycle-friendly design**
  - To maximize the recycling ratio of machine and component materials, as well as the ease of performing the recycling in the field, machine sections and components are designed so that the recyclable parts can be separated out easily.
  - In addition, components are designed so that they can be reused for as long as possible after the machine has reached its operational lifetime.

No additional notes

2. Energy Saving

2.1 Overview – 1

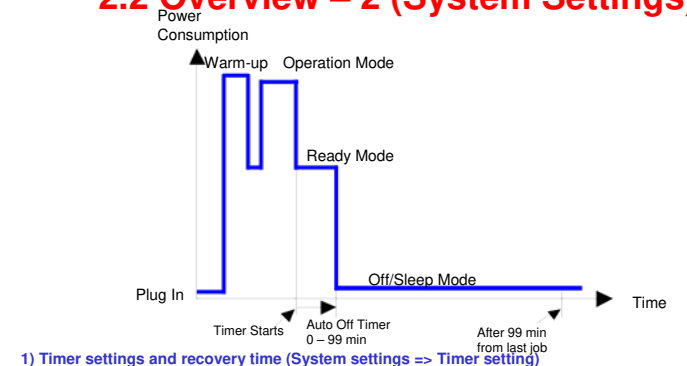


Energy Saver Modes	Description
Sleep Mode	Reduces power consumption.

- When the machine is not being used, the machine enters energy saver mode to reduce the power consumption by turning off the LCD of the operation panel and lowering the fusing temperature.
- The area shaded green in this diagram represents the amount of energy that is saved when the timers are at the default settings. If the timers are changed, then the energy saved will be different. For example, if the timers are all set to 99 minutes, the green area will disappear, and no energy is saved before 99 minutes expires.
- Power consumption during warm-up may be much higher than shown in this diagram.

2. Energy Saving

2.2 Overview – 2 (System Settings)



1) Timer settings and recovery time (System settings => Timer setting)

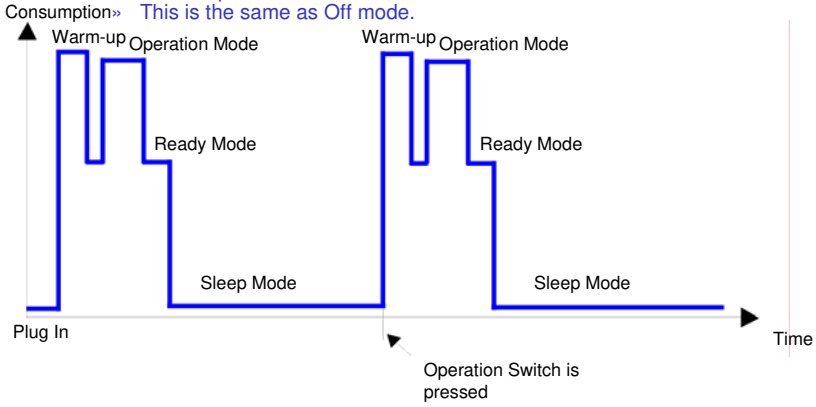
Mode	Timer	Default	Setting range	Recovery time
Sleep Mode	Auto Off Timer	5 min.	0 to 99 min.	18 s

- The user can set this timer with the printer properties. (In MS Windows access the printer dialog either via the Control Panel or within the application via Alt + F + P.)
  Printer → Properties → Advanced Tab → Device Options icon → Sleep Time.
- We recommend that the default settings should be kept.
  - If the customer requests that these settings should be changed, please explain that their energy costs could increase, and that they should consider the effects on the environment of extra energy use.
  - If it is necessary to change the settings, please try to make sure that the Auto Off timer is not too long. Try with a shorter setting first, such as 30 minutes, then go to a longer one (such as 60 minutes) if the customer is not satisfied.
  - If the timers are all set to the maximum value, the machine will not begin saving energy until 240 minutes has expired after the last job. This means that after the customer has finished using the machine for the day, energy will be consumed that could otherwise be saved.
  - If you change the settings, the energy consumed can be measured using SP8941, as explained later in this presentation.
- Power consumption during warm-up may be much higher than shown in this diagram.

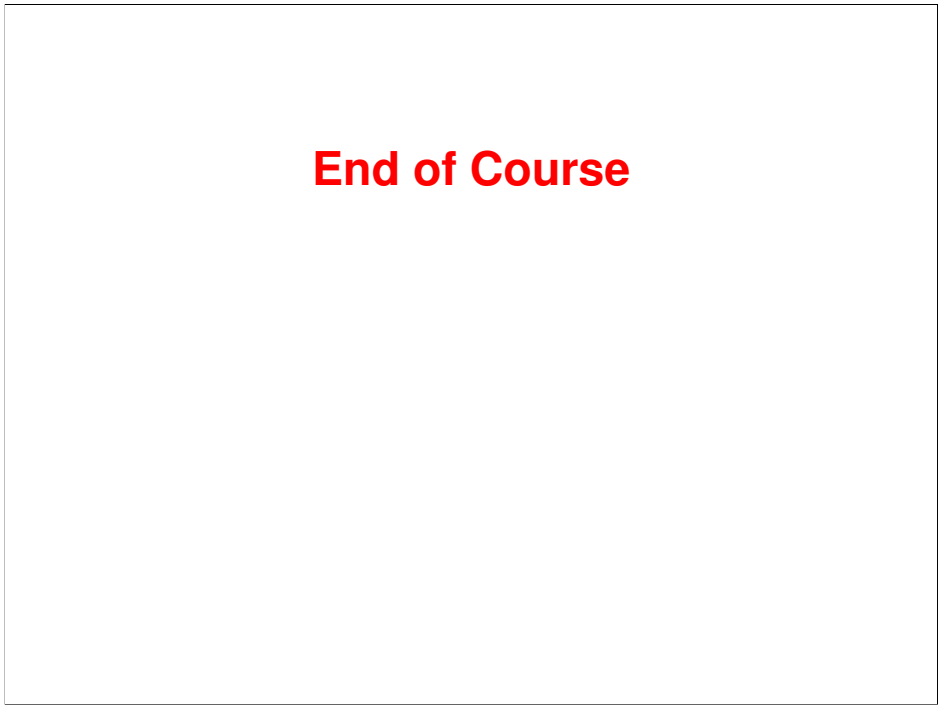
2. Energy Saving

2.2 Energy Saver Mode: Sleep Mode – 3

- **The machine recovers to the ready condition:**
  - **If the operation switch is pressed**
    - » The operation panel lights. When warm-up is finished, the machine goes to the ready condition.
    - » Then, after the job is completed, the machine returns to sleep mode (via ready mode) when the auto off timer runs out or the operation switch is pressed.
    - » This is the same as Off mode.



- This timing chart shows what happens if the operation switch is pressed while the machine in off mode.
- Power consumption during warm-up may be much higher than shown in this diagram.



No additional notes.