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# MODEL SH-P1 TRAINING
# Machine Codes: M020/M021

**Version 1.0**

Slide 1

- This course is for the SK-P1 series of copiers.

**Modifications**

- Started 22 February, 2011.
- Release version -- 8 March 2011.

# Course Contents

- Product Outline
  - Introduction
  - Specifications
  - Options
- Installation
- Transporting the Machine
- Maintenance
- Machine Overview
- Paper Feed
- Laser Exposure
- All In One Cartridge (AIO)
- Fusing
- Paper Exit
- Duplex
- Optional Paper Tray Units (M386, M389)
- Environmental Conservation

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# PRODUCT OUTLINE

## Introduction

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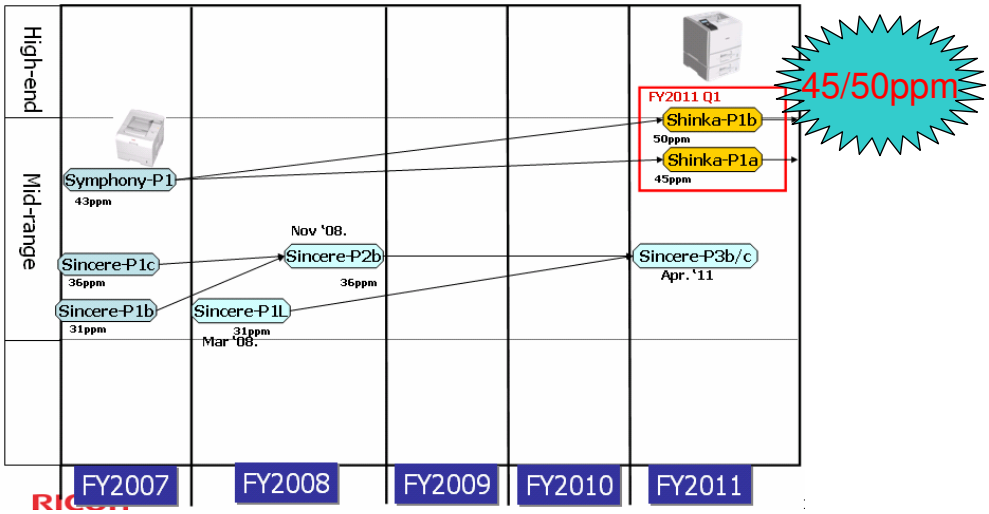
**No additional notes**

# Machine Concepts

## ❑ Product Placement




## ❑ Concepts

1. There is not a predecessor model. (New engine)
2. New AIO was developed to achieve B&W 45/50ppm.
3. User install & User maintenance.

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**No additional notes.**

# How many Models?

- **Two models**
  - SH-P1a 45 ppm model
    - » Code: M020
    - » Product Names: SP5200DN, Aficio SP5200DN
  - SH-P1b 50 ppm model
    - » Code: M021
    - » Product Names: SP5210DN, Aficio SP5210DN

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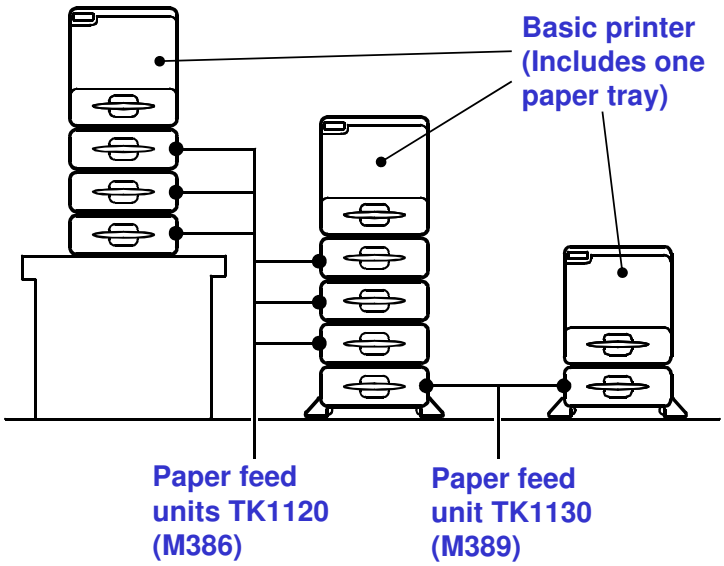
**No additional notes.**

# Configuration

- Configuration depends on the number of optional paper feed units.
- If the printer is installed on the floor, the bottom paper feed unit must be a TK1130 (has casters).

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- Up to four paper feed units can be added as options with a maximum of three TK1120 units. If installed on the floor, the lowermost paper feed unit should be TK1130 (has casters and stabilizers).
- The standard paper tray and the optional paper feed units hold 550 sheets of paper each (80 g/m$^2$).

# Options

- **This table shows the options available for this product. (Some are standard for the SH-P1b.)**

| Option | Code | SH-P1a (M020) | SH-P1b (M021) |
|---|---|---|---|
| Paper feed unit TK1120 | M386 | Option | Option |
| Paper feed unit TK1130 | M389 | Option | Option |
| HDD Type 2670 (1) | M352 | Option | Standard |
| Memory unit type G (256 MB) | D362 | Option | Standard |
| Memory unit type I (512 MB) | D435 | Option | Standard |
| Gigabit Ethernet board type A | G874 | Option | Option |
| IEEE 802.11a/b/g type M/L (2) | D344 | Option | Option |
| VM card type O | M385 | Option | Standard |
| IEEE 1284 interface board type A | B679 | Option | Option |
| SD card for fonts type C | M352 | Option | Option |
| IPDS unit type 5200 | M38805 | Option | Option |
| SD card for NetWare printing type E | M38803 | Option | Option |

(1) Includes data overwrite security and HDD encryption.

(2) Wireless LAN – type M for Europe and Asia, type L for North America

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**No additional notes.**

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# PRODUCT OUTLINE

## Specifications

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**This section explains the important specifications.**

# Specifications 1

- **Print Rate**
  - SH-P1a: 45 ppm (A4), 47 ppm (LT)
  - SH-P1b: 50 ppm (A4), 52 ppm (LT)
- **First Print Time**
  - 7.5 seconds or less (A4/LT SEF)
- **Warm-up Time (from main switch on)**
  - 20 seconds or less
- **Max Power Consumption**
  - SH-P1a: Less than 830W
  - SH-P1b: Less than 900W
- **Max Paper Size**
  - A4/LT

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**No additional notes.**

# Specifications 2

- **Paper Feed Capacity (LT/A4, 80g/m²)**
  - Standard Tray: 550 sheets
  - Optional Trays: 550 sheets each (up to 4)
  - Bypass tray: 100 sheets
- **Paper Output Capacity (LT/A4 , 80g/m²)**
  - Up to 500 sheets
- **Paper Weight**
  - Standard Tray, Optional Trays, By-pass Tray: 52-220 g/m², 14-59 lb
  - Duplex: 60-163 g/m², 16-44 lb
- **Resolution**
  - 600 x 600 dpi, 1200 x600 dpi

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❒ For additional and more detailed specifications, see the FSM.

# Reliability Targets

- **Average print volume per month:**
  - SH-P1a: 4K
  - SH-P1b: 5K
- **Maximum print volume per month: 15 K**
- **Installation Time Estimation: 15 minutes**
- **MPBF (Mean Prints Between Failure):**
  - SH-P1a: 114 K
  - SH-P1b: 143 K
- **Machine Life: 900k or 5 years**

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**No additional notes**

# Product Outline

## Options and Consumables

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**No additional notes**

# Optional Units

- **Paper handling options**
  - One TK1130 550-sheet paper feed unit (with casters)
  - Up to three TK1120 550-sheet paper feed units (without casters)
- **Controller options**
  - IEEE802.11a/g Type M: Same as K-P2
  - IEEE802.11a/g Type L: Same as K-P2
  - Gigabit Ethernet Type C: Same as SI-P3
  - Gigabit Ethernet Type A: Same as K-P2
  - IEEE1284 Interface Board Type A: Same as K-P2
- **Others**
  - Hard Disk Drive Type 4310 (Standard on SH-P1b): Same as SI-P3
  - Memory Unit Type I 512MB (Standard on SH-P1b): Same as Z-P1
  - Memory Unit Type G 256MB (Standard on SH-P1b): Same as K-P2
  - VM Card Type O (Standard on SH-P1b): Same as Z-P1
  - SD Card for Fonts Type C: Same as SI-P2
  - SD Card for Netware Printing Type E: New
  - IPDS Unit Type 5200: New

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- Only one option can be installed in the I/F slot.

# User Installable vs Service Installable Options

| | Location |
|---|---|
| ● User installable options | |
| Wireless LAN IEEE802.11a/g Type M | I/F slot |
| Wireless LAN IEEE802.11a/g Type L | I/F slot |
| Gigabit Ethernet Type A | I/F slot |
| Gigabit Ethernet Type C | I/F slot |
| IEEE1284 Interface Board Type A | I/F slot |
| Hard Disk Drive Type 4310 | Controller board |
| Memory Unit Type I 512 MB | Controller board |
| Memory Unit Type G 256 MB | Controller board |
| SD Card for Fonts Type C | SD card |
| SD Card for Netware Printing Type E | SD card |
| ● Service installable options | |
| IPDS Unit Type 5210 | SD card |
| VM Card Type O | SD card |

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- ❒ Only one option can be installed in the I/F slot.
- ❒ Refer to the previous slide for information on which options are new and which are common with other products.

# Optional Paper Trays

- You can install up to four optional paper trays.
- If installed on the floor, the bottom tray must be TK1130 because it has casters. Stabilizers must also be attached, as shown below.


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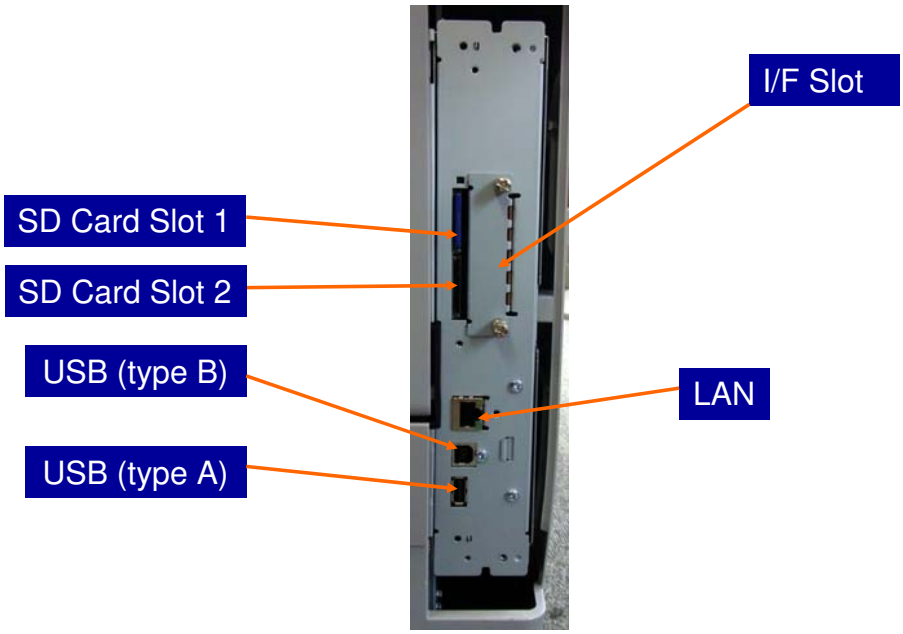
**No additional notes**

# Slots/Plugs for Controller Options




- **One of three options can be installed in the I/F slot -- Wireless LAN, Gigabit Ethernet, or IEEE 1284 interface board .**

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- The SD Card slots are discussed in more detail on the next few slides.
- Remove the covers to access the SD card slots and I/F slot.

# SD Card Slots

- **Slot 1 (upper slot)**
  - M021 only: Contains the Security SD Card when shipped
    - » The Security SD Card contains the Data Overwrite Security unit and HDD Encryption Unit.
  - Used for running programs
- **Slot 2 (lower slot)**
  - Empty when shipped.
  - Contains the VM card after the machine's installation procedure. (Standard for M021, option for M020)
  - Use this slot for service procedures, such as firmware update and NVRAM backup.

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**No additional notes**

# Installation

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**No additional notes.**

# Overview

- **The user installs this machine.**
- **However you should also know how to install the machine in the event you are asked to do so in the field.**
- **Refer to the following user's documents.**
  - SH-P1 field service manual, installation section
  - Quick installation guide
  - Hardware guide

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**No additional notes**

## Before You Start

- **Read the notes for the following before you install the machine.**
  - Environment
  - Space requirements
  - Power requirements

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**No additional notes.**

# Transporting the Machine

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**No additional notes**

# Moving the Machine a Long Distance

- Make sure there is no paper left in the paper trays.
- Attach shipping tape to the covers and doors, or shrink-wrap the machine tightly.

Note: The machine may be moved either with or without an AIO installed.

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**No additional notes.**

# Maintenance

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**No additional notes**

# User/Service Maintenance

## ❑ User Maintenance

- This product has been designed for user maintenance using Maintenance Kit SP5200.
- Maintenance Kit SP5200 components
  - » Fusing unit (1)
  - » Transfer roller (1)
  - » Feed roller (5)
  - » Friction pad (5)
- Expected yield of this kit is 120,000.
  Yield calculated based on:
  - » A4 (LT) short-edge feed
  - » 5% image coverage
  - » 3 prints/job

## ❑ Service Maintenance

- Maintenance Kit SP5200 components are available individually as service parts.

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❒ The use of Maintenance Kit SP5200 depends on local marketing and service policy.

# Alert Display & Machine Condition

- **The table below shows the alert display for supply items.**

| Maintenance Kit | Action | Alert timing | Near End Alert Timing | Machine condition at the end | Alert: (Meter click charge OFF, SP5930-1 set to 0, = default) | | Alert: (Meter click charge ON, SP5930-1 set to 1) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Near end | End | Near end | End |
| **Print cartridge (AIO)** | Replace | 25K prints | 1250 prints before the end | Cannot print | Toner "Near End" message is shown | Toner "End" message is shown | Toner "Near End" message is shown (1) | Toner "End" message is shown (1) |
| **Kit SP5200** | Replace | 120K prints | 1250 prints before the end | Useable | Message is shown | Message is shown | Message is not shown (2) | Message is not shown (2) |

- **The yield figures in the above table are based on the following conditions:**
  - A4 (LT) short-edge feed
  - 5% image coverage
  - The expected yield measurement for the Print Cartridge is based on ISO 19798.
- **(1) In addition to the toner Near End/End messages, you can also turn on drum yield Near End/End messages with SP5930-003. 0 = message shown, 1 = message not shown (Default: 1)**
- **(2) SP5930-002 sets the display for Kit SP5200 when meter click charge is ON. 0 = message shown, 1 = message not shown (Default: 1)**

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**No additional notes.**

# PM Parts

- Pick up roller: 120k
- Fusing unit: 120k
- Transfer Roller: 120k
- Friction Pad: 120K

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**No additional notes.**

# PM Counter Reset

- **User Maintenance Mode (default)**
  - If the machine is set for user maintenance, all PM counters are automatically reset when maintenance kit parts are replaced.
- **Service Maintenance Mode (click charge set to ON with SP5930-001)**
  - The fusing unit counter resets automatically.
  - The following counters must be reset manually using SP7804.
    - » All clear: SP7804-002
    - » Transfer roller: SP7804-004
    - » Feed roller: SP7804-005
  - You can do a forced reset of the fusing unit with SP7804-003. (Useful if using a rebuilt fusing unit.)

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❒ Refer to "New Fusing Unit Detection" in the fusing section of this course.

# Machine Overview

## Components

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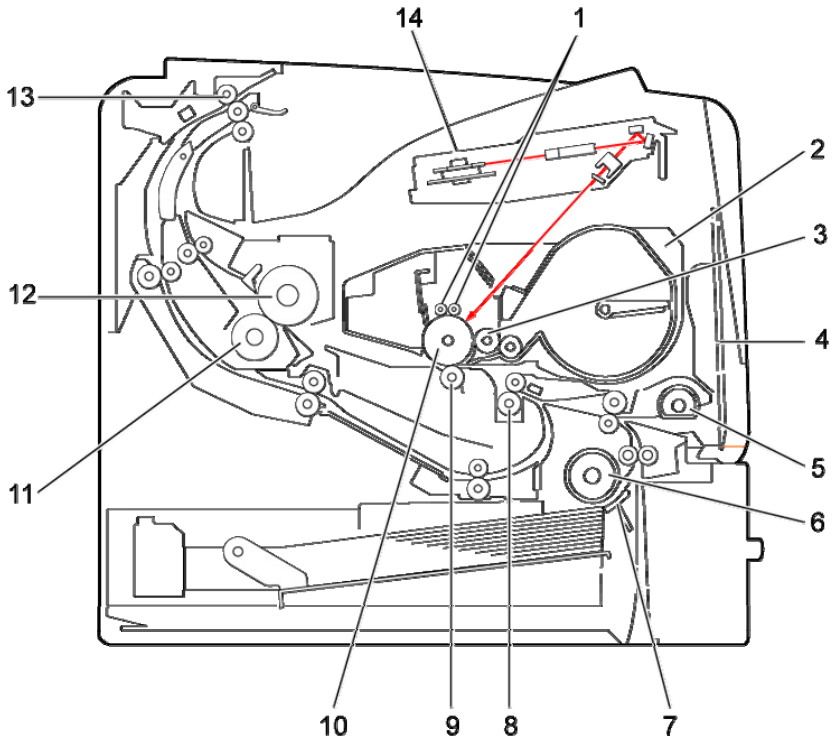
**PURPOSE OF THE SECTION**

**In this section you will :**

- ❒ Learn the locations of primary components
- ❒ Learn about the paper feed path

# Component Layout

1. Charge roller
2. Cartridge (AIO-type)
3. Development roller
4. By-pass feed tray
5. By-pass feed roller
6. Paper feed roller
7. Friction pad
8. Registration roller
9. Development roller
10. Drum
11. Pressure roller
12. Hot roller
13. Paper exit roller
14. Laser unit

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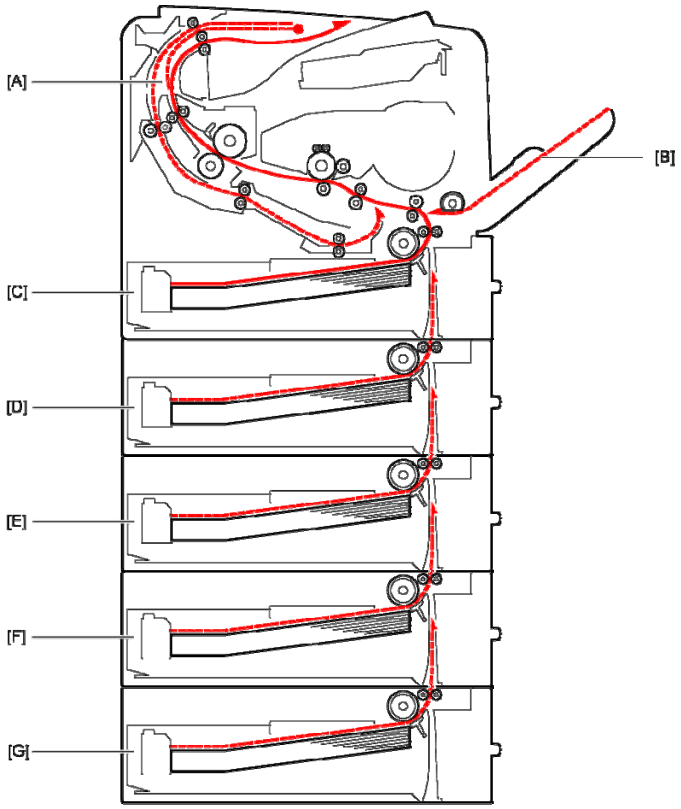
- This slide shows the major components. Details will be covered later.
- The AIO (all in one unit) contains the drum, charge rollers, toner, development mechanism, and drum cleaning mechanism.

# Paper Tray Configuration

[A] Duplex unit
[B] By-pass tray
[C] Standard paper tray (tray 1)
[D] - [G] Optional Paper Feed Units (tray 2 - 5)

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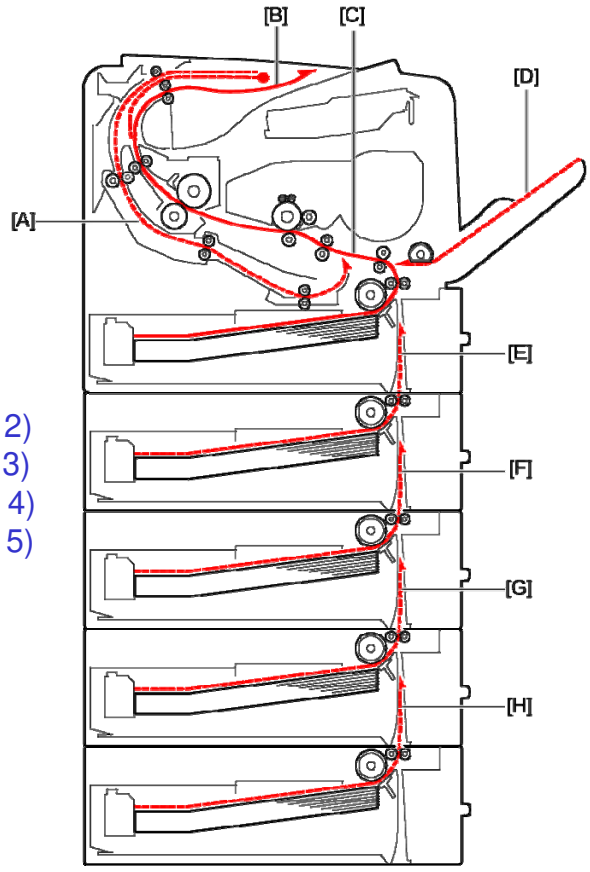
❒ This slide shows base printer with four optional paper trays installed.

# Paper Path

A: Paper feed through duplex unit
B: Paper exit to the paper stack
C: Paper feed from tray 1
D: Paper feed from by-pass tray
E: Paper feed from optional PFU (tray 2)
F: Paper feed from optional PFU (tray 3)
G: Paper feed from optional PFU (tray 4)
H: Paper feed from optional PFU (tray 5)

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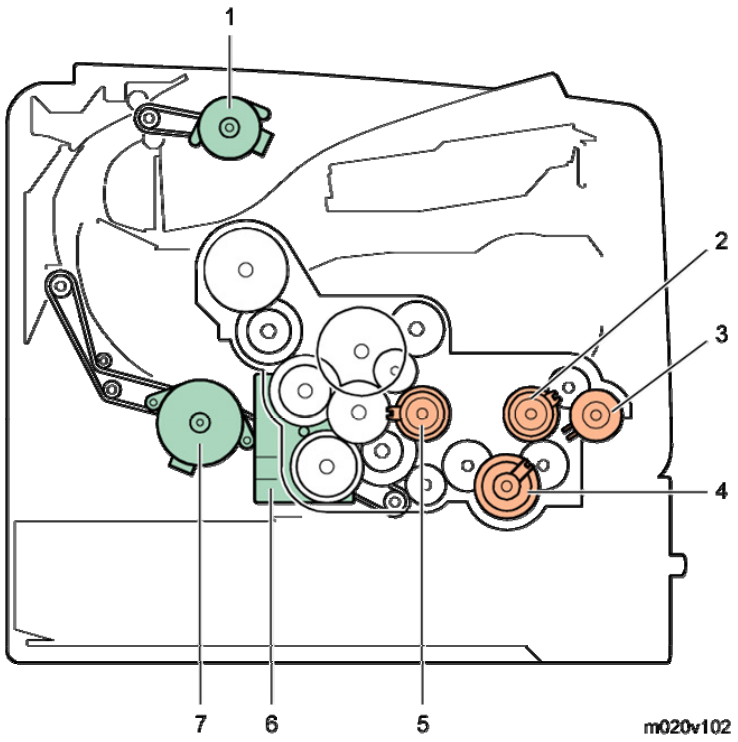
❒ This slide shows the paper path with four optional paper trays installed.

# Drive Layout

1. Paper exit motor
2. Relay clutch
3. By-pass feed clutch
4. Paper feed clutch
5. Registration clutch
6. Main motor
7. Duplex motor

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**No additional notes.**

# Circumference of Rollers

- **Abnormal image repeating at intervals may be related to a roller with a matching circumference.**
  - 113 mm: Feed roller
  - 94 mm: By-pass feed roller
  - 51.8 mm: Transport rollers
  - 50.7 mm: Registration rollers
  - 96 mm: Drum
  - 50 mm: Transfer roller
  - 117.8 mm: Hot roller
  - 100.5 mm: Pressure roller
  - 43.4 mm: Fusing exit rollers
  - 44 mm: Exit rollers
  - 45.5 mm: Duplex relay rollers
  - 52 mm: Development roller

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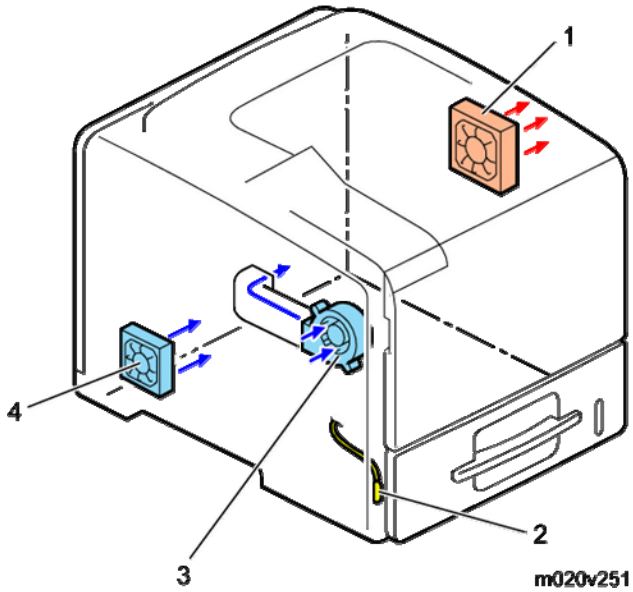
- This list may be useful during troubleshooting.

# Machine Ventilation

1. Exhaust fan
2. Transfer thermistor
3. AIO fan
4. PSU fan




- This machine uses two cooling fans and an exhaust fan.
- The CPU controls these fans referring to the data from the transfer thermistor [2] to prevent overheating.

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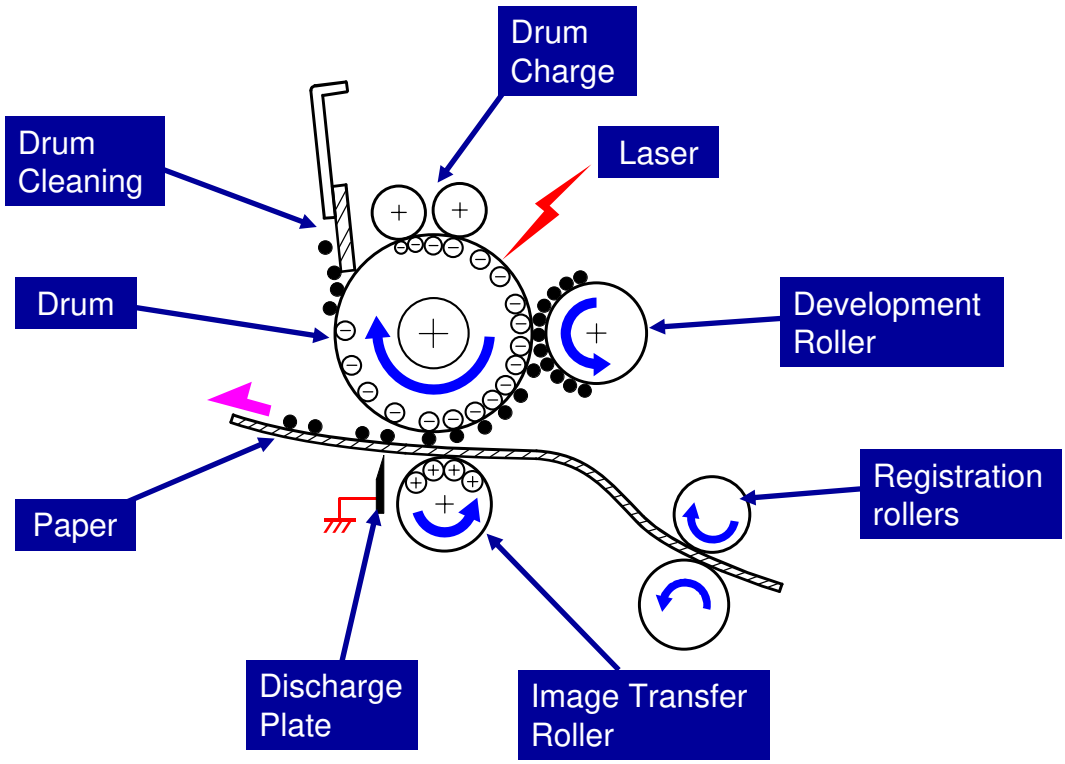
**No additional notes.**

# Printing Process

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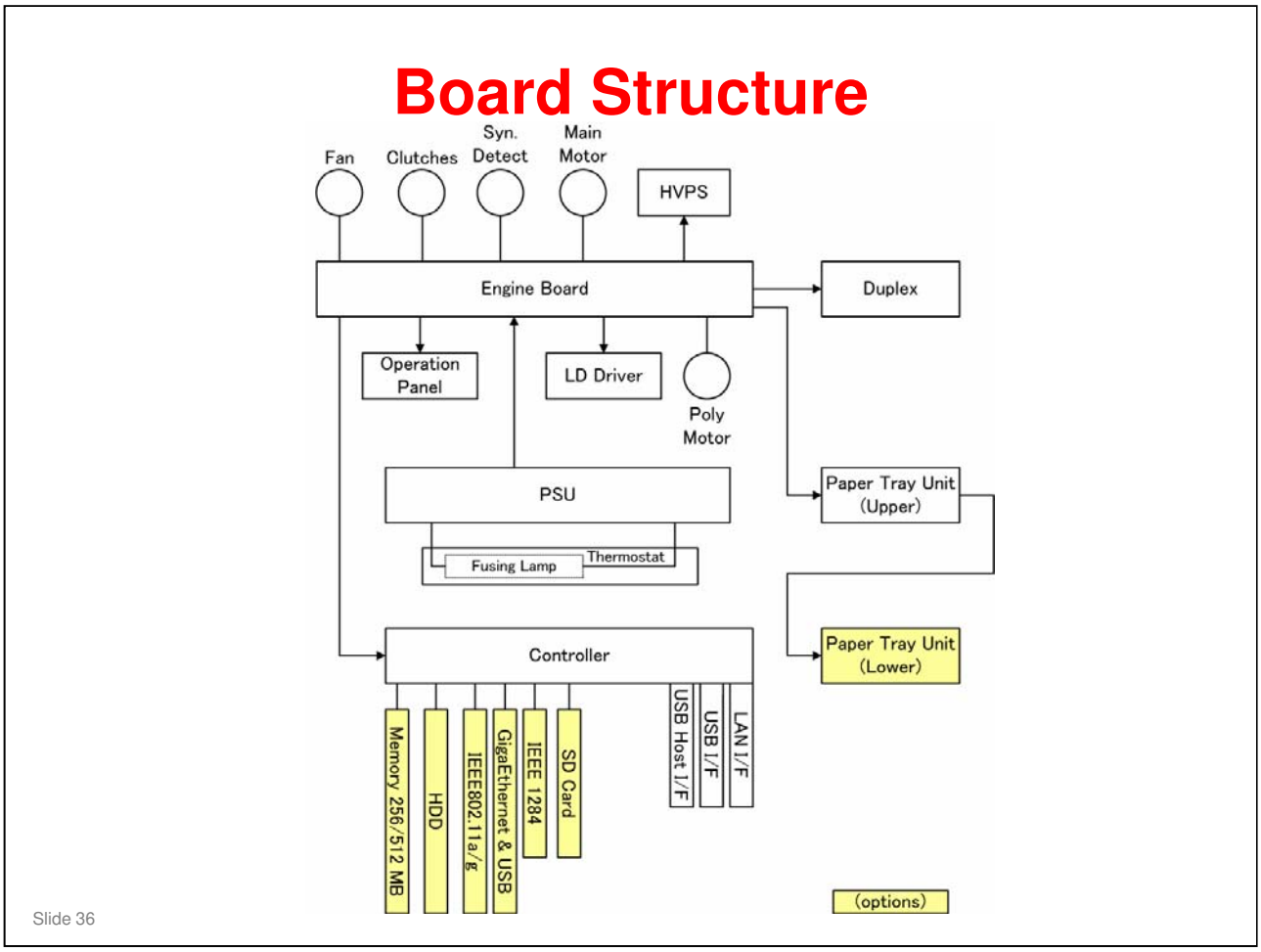
- The illustration shows the basic printing/copying processes.
  - Paper registration: The registration roller controls the paper feed timing to make sure that the image transfers to the correct location on the paper. It also removes skew.
  - Drum charge: The charge rollers give the drum a negative charge
  - Laser exposure: To make a latent image on the drum, the machine turns the laser beam on and off.
  - Development: The development roller moves toner to the drum where the toner is attracted to the latent image on the drum surface.
  - Image transfer: The charge that is applied to the image transfer roller pulls the toner from the drum to the paper.
  - Separation: The paper separates from the drum. The discharge plate immediately after the transfer roller helps to remove the paper from the drum.
  - Cleaning: The cleaning blade removes any toner remaining on the drum surface after the image transfers to the paper.
- Refer to the Core Technology manual for more information about basic processes.




**Engine Board:**

- The engine board controls all the mechanical components and the following functions:
  - Engine sequence
  - Engine operation
  - Operation panel

**Controller:**

- The controller handles the following functions:
  - HDD
  - Network interface
  - USB and SD cards

# Before You Start Work on the Machine

- Turn off the main power switch, check that the shutdown process has finished, then unplug the machine before you start to remove components from the machine.

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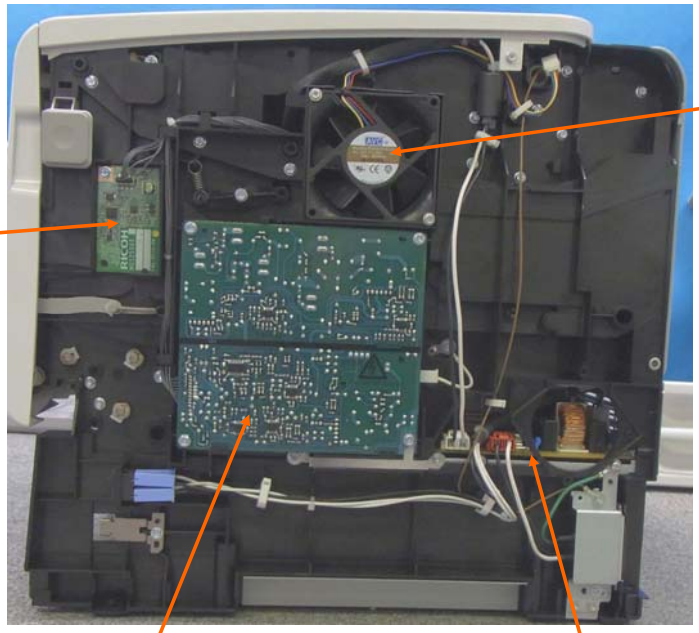
**No additional notes**

# Component Location: Right Cover Off

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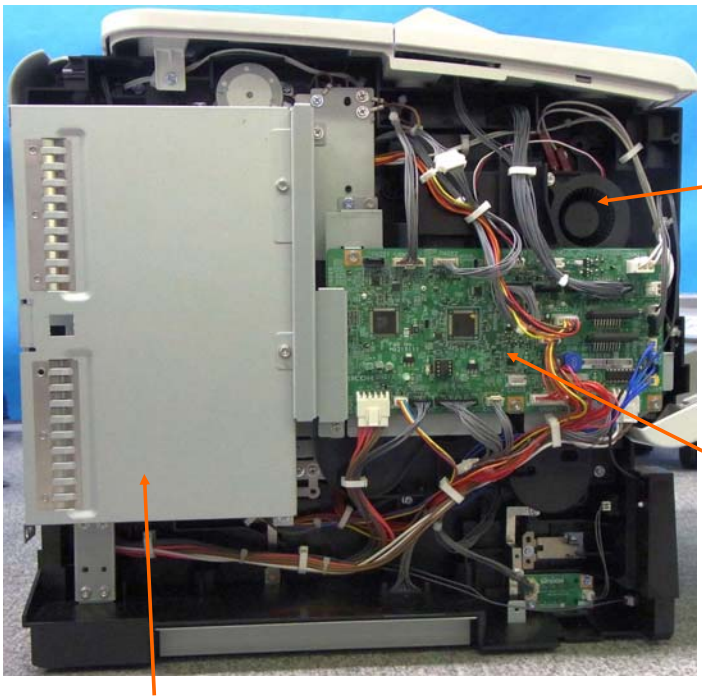
- PSU = Power supply unit
  HVPP = High voltage power pack
  RFID = Radio frequency identification

# Component Location: Left Cover Off

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**No additional notes.**

# Replacing the Engine Board – 1

- Print out the SMC first.
- When you replace the Engine Board, remove the EEPROM from the old Engine Board and install it on the new one.
- Make sure the EEPROM is oriented correctly.
  - The notch must be oriented as shown in the illustration on the next slide.
- Enter the S/N with SP5811-4.
- Refer to the FSM for the detailed Engine Board replacement procedure.

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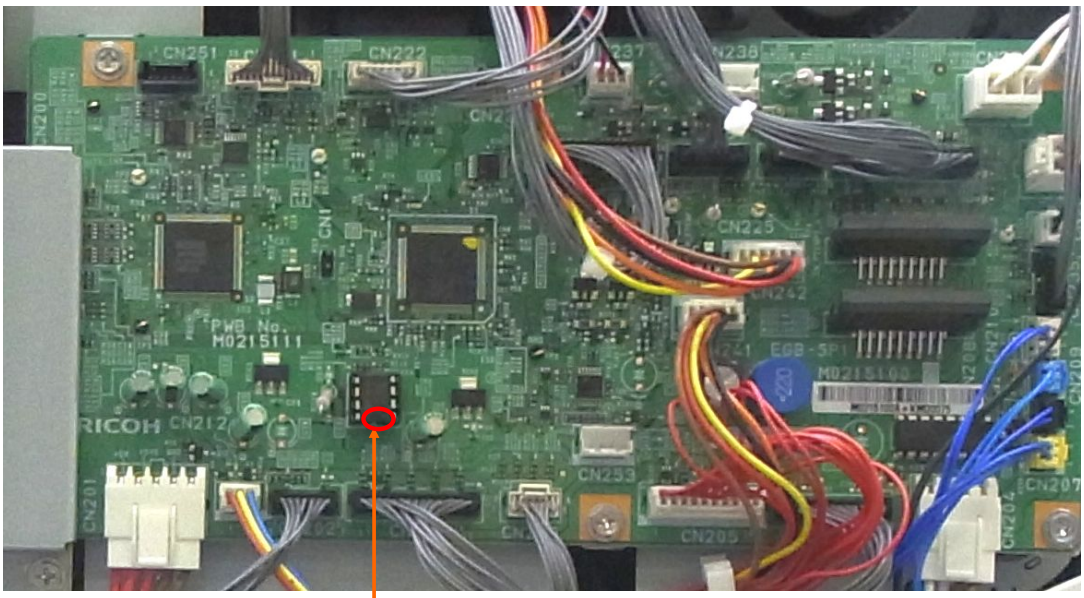
**No additional notes**

# Replacing the Engine Board – 2




Notch

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- Insert the EEPROM in the proper position and make sure it is oriented correctly.
- If replacing the EEPROM but not the BICU, follow the procedure in the FSM.

# Replacing the Engine Board EEPROM (Data is Alive)

- ❑ Make sure you have the SMC report (factory settings) that comes with machine.
- ❑ Print out the SMC first if possible.
- ❑ Copy EEPROM data to SD card with SP5-824-001 if possible.
- ❑ Install new EEPROM on the Engine Board.
- ❑ Make sure the EEPROM is oriented correctly.
  - The notch must be oriented as shown in the illustration on the previous slide.
- ❑ Copy the data from SD card to EEPROM with SP5-825-001.
- ❑ Refer to the FSM for the detailed EEPROM replacement procedure.
- ✓ Ask supervisor for details.

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**No additional notes.**

# Replacing the Engine Board EEPROM (Data is Dead)

- Make sure you have the SMC report (factory settings) that comes with machine.
- Input the factory settings manually.

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**No additional notes.**

# Replacing the Controller – 1

- Print out the SMC first.
- When you replace the controller, remove the 2 NVRAMs from the old controller and install them on the new one.
- Make sure the NVRAMs are oriented correctly.
  - The notches should be oriented as shown in the illustration on the next slide.
- The 45 ppm and 50 ppm machines have different controller boards. Don't mix them up!
- Don't change the DIP switches.
- Refer to the FSM for the detailed controller replacement procedure.

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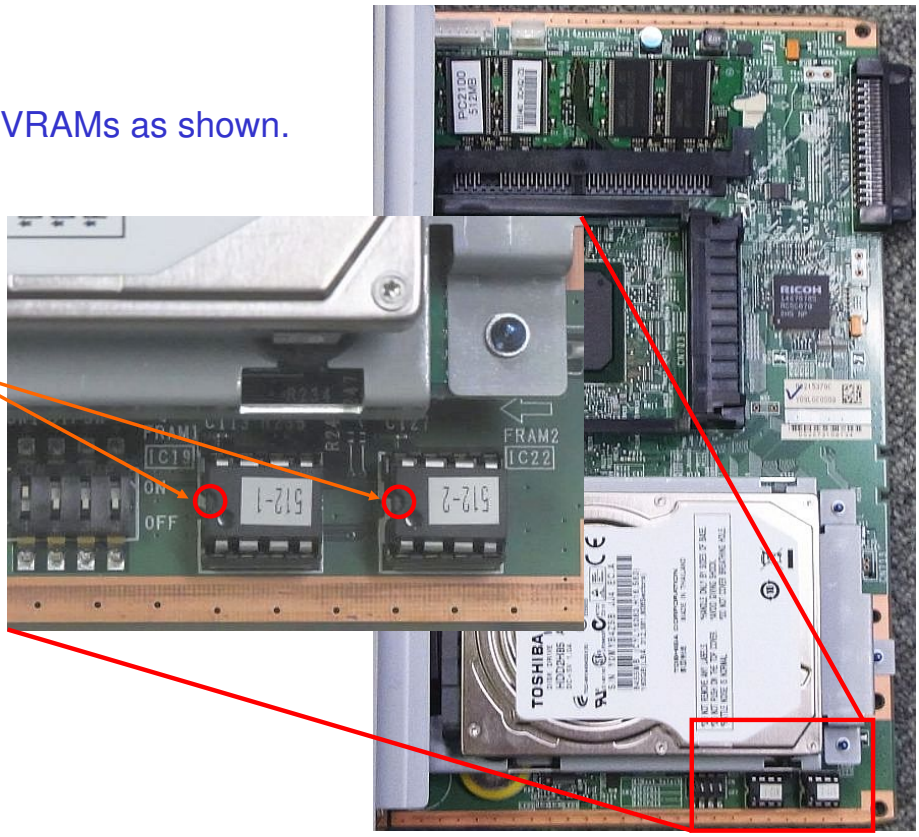
**No additional notes.**

# Replacing the Controller – 2

Orient the NVRAMs as shown.

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**No additional notes.**

# Replacing the NVRAMs (Data is alive)

- ❑ **Make sure you have the SMC report (factory settings) that comes with machine.**
- ❑ **Print out the SMC first if possible.**
- ❑ **Copy NVRAM data to SD card with SP5-824-001 if possible.**
- ❑ **Replace new NVRAM on the Controller board.**
- ❑ **Make sure the NVRAM units are oriented correctly.**
  - The notches must be oriented as shown in the illustration on the previous slide.
- ❑ **Copy the data from SD card to NVRAM with SP5-825-001.**
- ❑ **Refer to the FSM for the detailed Controller board replacement procedure.**
- ✓ **The value of Total counter is reset to "0" when NVRAM is replaced.**
- ✓ **When Encryption is ON please refer to the information RTB issued separately. (See notes below.)**

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❒ At the time of writing, the latest information was in general RTB "RGene039". However, this RTB was scheduled for update; so, consult your RTB database or the service supervisor.

# Replacing the NVRAMs (Data is Dead)

- Make sure you have the SMC report (factory settings) that comes with machine.
- Input the factory settings manually.

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**No additional notes.**

# Paper Feed

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**PURPOSE OF THIS SECTION**

- ❒ The paper feed mechanisms for the main body (tray 1, bypass tray) will be described in this section. The optional feed units will be dealt with in a later section.

**In this section you will do the following:**

- ❒ Learn how the paper feed mechanisms are driven.
- ❒ Learn how paper size is detected.

# Overview

## Paper Tray

- Paper Feed System: Feed roller and friction pad
- Paper Lift Mechanism: Tray arm and spring
- Paper Detection: Remaining paper sensors & paper end sensor
- Paper Size Detection: Paper size switch
- Tray Capacity: 550 sheets
- Tray Extension: Available

## By-pass Tray

- Paper Feed System: Feed roller and friction pad
- Paper Lift Mechanism: Cams and springs
- Paper Detection: By-pass tray paper sensor
- Paper Size Detection: None
- Tray Capacity:100 sheets

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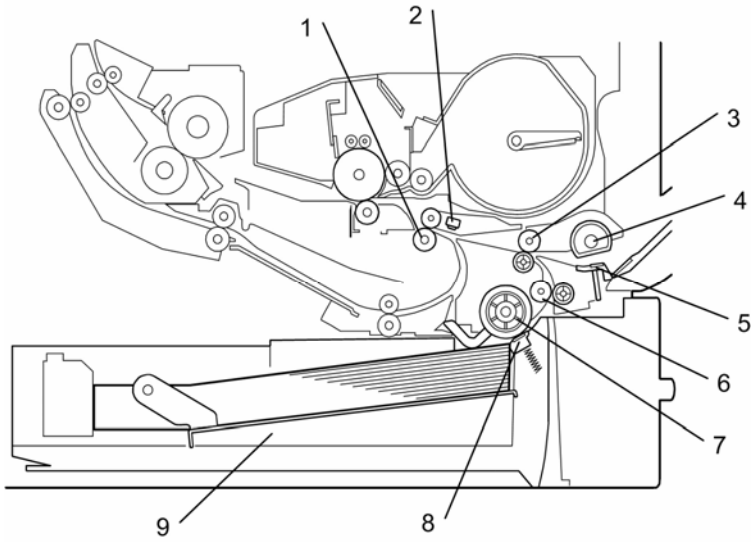
**No additional notes**

# Paper Feed Components

1. Registration Rollers
2. Registration sensor
3. Upper relay rollers
4. By-pass feed roller
5. By-pass friction pad
6. Lower relay rollers
7. Tray feed roller
8. Friction pad
9. Paper tray




- The trays and by-pass all use a friction pad feed mechanism.

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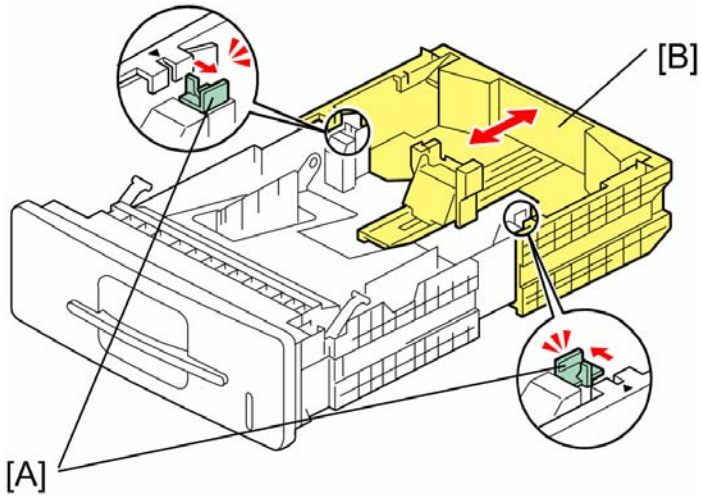
**Additional notes:**

- The friction pad cannot be adjusted.
- The machine makes the paper buckle at the registration rollers to correct paper skew.
- The paper buckle can be adjusted for each paper type with SP 1003.

# Tray Extension

- **The user can extend the tray manually to hold paper longer than A4/Letter size.**
- **To use longer paper:**
  - Release the two locks [A]
  - Extend the tray [B] and close the locks.

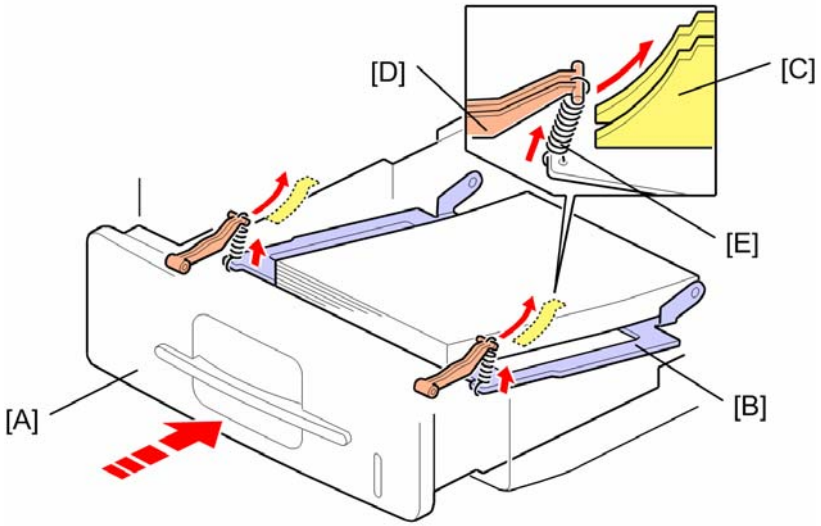



## Paper Sizes

| Tray Mode | Possible Paper Sizes |
|---|---|
| Short (default) | A5 (LEF/SEF), B5 (SEF), A4 (SEF), LT (SEF) |
| Long | LG (SEF), 8.5" x 13" (SEF), 8" x 13" (SEF), 8.25" x 13" (SEF) |

Slide 51

# Paper Lift



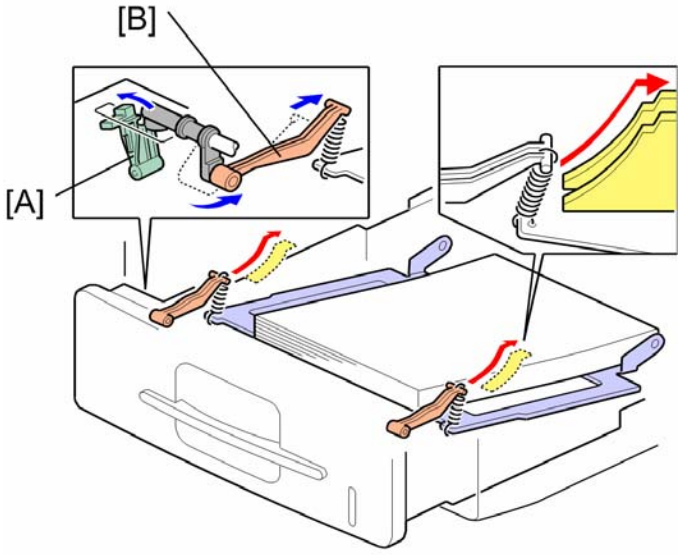

- **When the tray [A] is pushed into the machine, the bottom plate [B] lifts as follows.**
  - The slopes on the guide blocks [C] on the machine lift up the tray arms [D].
  - The springs [E] between the tray arms and bottom plate lift the plate.

Slide 52

**No additional notes.**

# Tray Lift Pressure Adjustment

- Normal position (right) for paper 105 g/m2 or less (28 lb or less)
- Thicker paper position (left) for paper more than 105 g/m2 (28 lb)



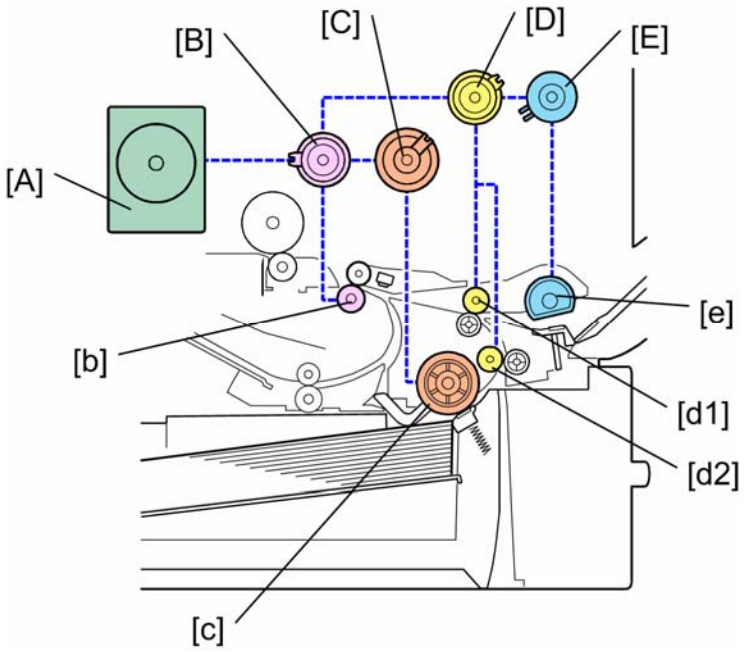

- The paper thickness selector [A] can change the lift pressure of the bottom plate. When changing the position of the paper thickness selector from the normal position (right) to thicker paper position (left), the tray arms move to the rear side a little bit. As a result, the spring tension of the tray arms is stronger than before changing the selector's position.

Slide 53

**No additional notes.**

# Paper Feed Drive

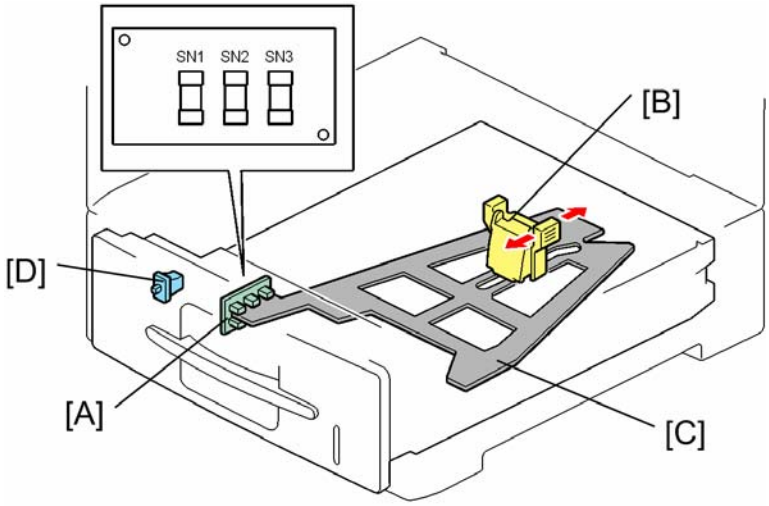
- **The main motor [A] drives all rollers related with the paper feeding via gears and clutches. Each clutch corresponds with a roller as follows:**
  - Registration clutch [B]: Registration roller [b]
  - Paper feed clutch [C]: Feed roller [c]
  - Relay clutch [D]: Upper relay roller [d1] and lower relay roller [d2]
  - By-pass feed clutch [E]: By-pass feed roller [e]




Slide 54

**No additional notes.**

# Paper Size Detection




- The paper size detection sensor board [A] detects the size of the paper in the paper tray.
- Sliding the end fence [B] changes the position of the paper size actuator [C].
- Paper size detection occurs after the tray set switch [D] detects the paper tray.
- See the paper size detection table on the next slide.

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**No additional notes.**

# Paper Size Detection Table

| Size | SN1 | SN2 | SN3 |
|---|---|---|---|
| A4 SEF | ON | ON | OFF |
| A5 SEF | ON | OFF | ON |
| B5 SEF | OFF | ON | OFF |
| Custom size | ON | OFF | OFF |
| LG SEF | OFF | OFF | OFF |
| LT SEF | OFF | OFF | ON |
| HLT SEF | OFF | ON | ON |

- The paper size detection sensor board determines the paper size based on the switch combination as shown in the paper size detection table above.

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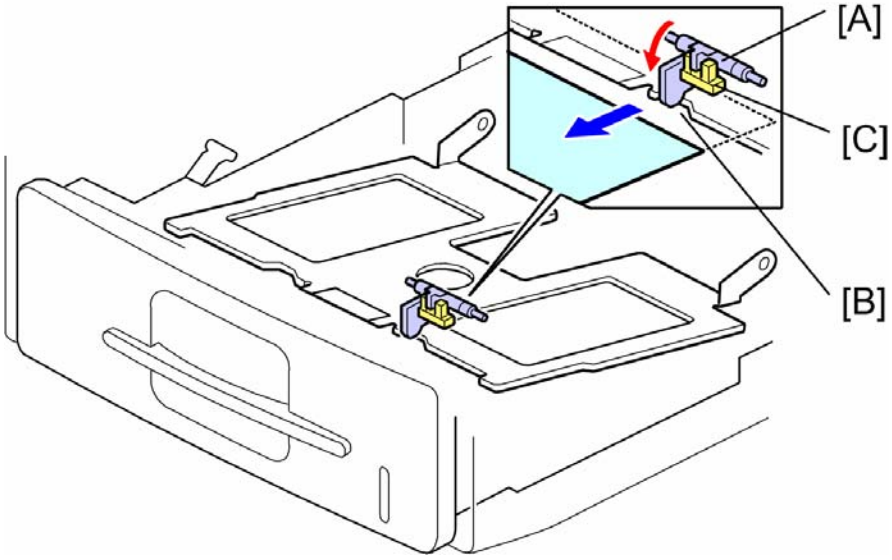
**No additional notes.**

# Paper End Detection




- When there is no paper in the tray, the feeler [A] falls into the cutout [B] in the bottom plate, and the paper end sensor [C] comes on.

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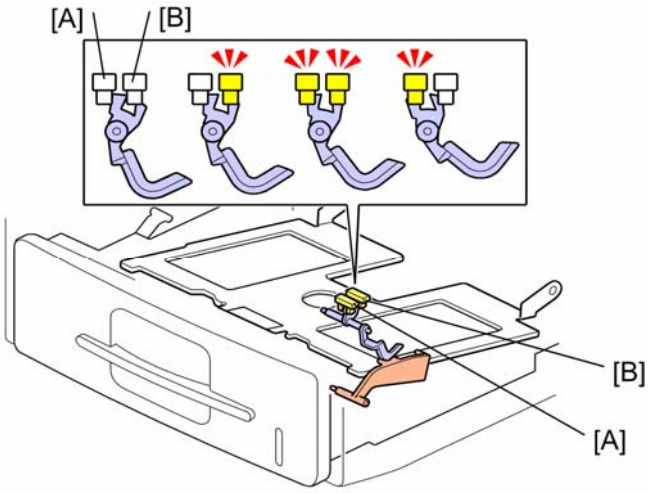
**No additional notes.**

# Remaining Paper Detection

- Remaining paper is detected by the combination of the remaining paper sensor signals.
- The signals from the sensors indicate whether there are 500, 450, 250, or 50 sheets remaining.
  - [A] Remaining paper sensor 1
  - [B] Remaining paper sensor 2




| Amount of paper | Sensor 1 | Sensor 2 |
|---|---|---|
| 1-50 sheets (10%) | OFF | OFF |
| 51-250 sheets (50%) | OFF | ON |
| 251-450 sheets (90%) | ON | ON |
| 451-550 sheets (100%) | ON | OFF |

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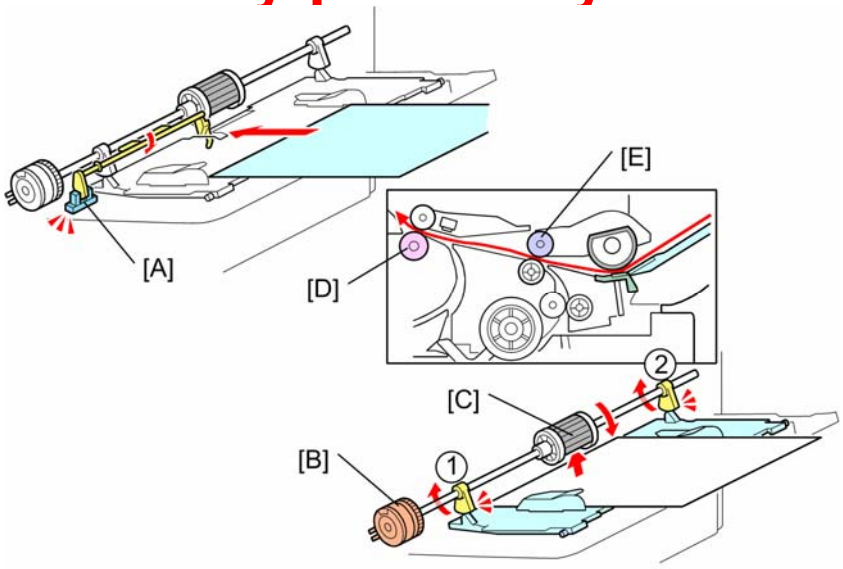
**No additional notes.**

# By-pass Tray




- **The by-pass paper sensor [A] detects when paper is placed on the tray.**
- **The CPU energizes the by-pass clutch [B]. Then the by-pass feed roller [C] starts to feed paper to the registration roller [D] through the relay roller [E].**
- **The by-pass feed roller shaft has two cams (1), (2). These cams release the bottom plate to press the stack of paper against the by-pass feed roller. There is no width sensor.**

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- To prevent bad effects from too much friction between the feed roller and friction pad, the by-pass feed roller contains a metal plate.

# Laser Exposure

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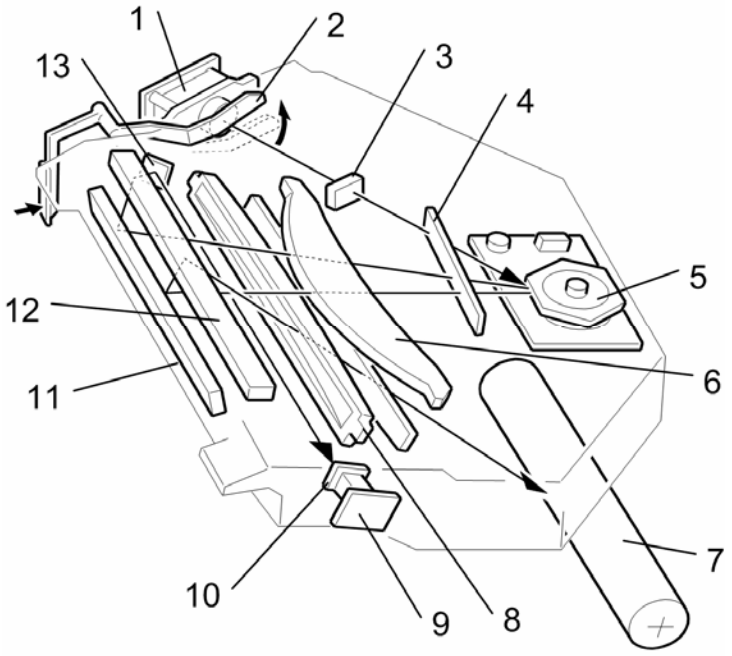
**No additional notes.**

# Laser Unit Components

1. LD unit
2. Laser shutter
3. Cylindrical lens
4. Shield glass
5. Polygon mirror
6. L1 lens
7. Drum
8. L2 Lens
9. Synchronization detector
10. Toroidal lens
11. 1st mirror
12. 2nd mirror
13. Detector mirror

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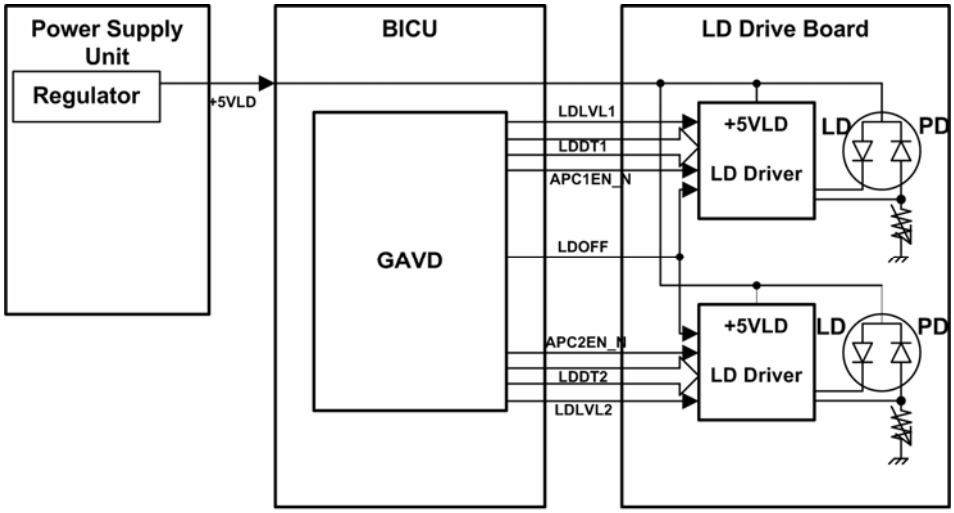
- Synchronization detector: The 1st mirror, 2nd mirror, and the detector mirror reflect the beam from the LD unit to the synchronization detector.
- Two laser beams: The LD unit writes two lines at the same time.
- LD safety shutter: When the user opens the front cover, the shutter closes and blocks the laser beam path.
- After you replace the LD unit, adjust its position (see Replacement and Adjustment).
- There is a thermistor next to the laser unit (not shown) that checks the temperature inside the machine. The machine automatically corrects the charge roller and transfer voltages based on this temperature.

# Automatic Power Control (APC)

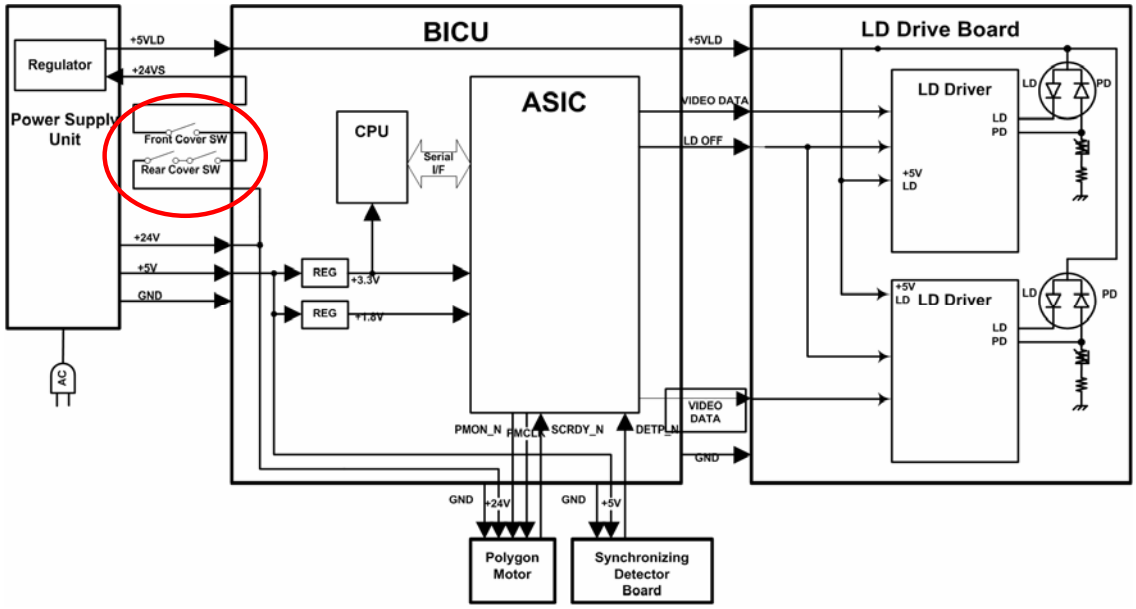



- **The LD driver on the LD drive board automatically controls power for the laser diodes.**
- **The laser diode power is adjusted in the factory.**
  - Never adjust the variable resistors on the LD unit in the field.

Slide 62

**No additional notes.**

# Laser Safety Switch




- **Safety switches cut power to the LD drive board when a cover is opened.**

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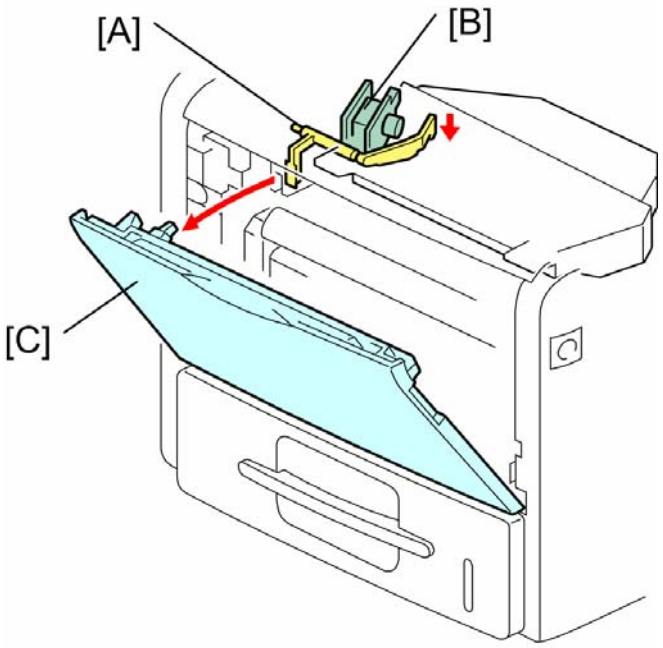
**Additional details:**

- A safety switch turns off when the front cover or the rear door is opened. As a result, the relay on the PSU cuts off the power supply (+5V) to the LD board. (The electric circuits go through the engine board)
- This system prevents unexpected laser emission, and ensures user safety and technician safety.

# Laser Shutter

- The laser shutter [A] provides back-up to the safety switches (previous slide).
- Even if the switches do not work and power gets to the laser diodes [B], the laser shutter physically stops the laser beam when the front cover [C] is open.

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**No additional notes.**

# All In One Cartridge (AIO)

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# Achieving 50 CPM with Mono-component Toner

- **New toner**
  - New toner was developed to improve fusibility and development at higher speed. (Toner is modified based on Midas/Per' toner.)
  - The silica component of the toner is decreased compared to the Midas/Per' toner.
    - » Merits:
      - – reduces metering blade wear
      - – extends the life of the development roller
    - » Demerit:
      - – The margin for smudged image is decreased. (However, there is no problem on actual usage.)
- **Development roller**
  - Uses a larger circumference development roller
- **Dual charge rollers**
  - To ensure the sufficient charging for the life of AIO, the SH-MF1/P1 machines use two charge rollers. (In high speed machines, there is a possibility that charge rollers become dirty.)

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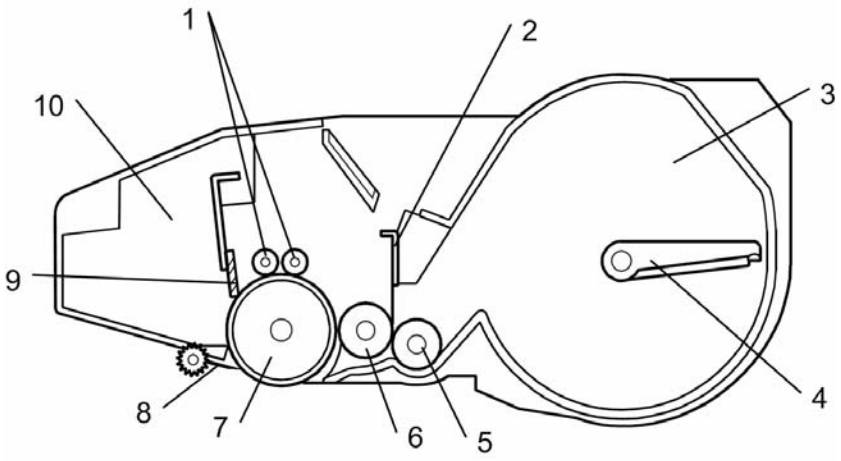
**No additional notes.**

# AIO Components

1. Charge rollers
2. Metering blade
3. Toner tank
4. Agitator
5. Toner supply roller
6. Development roller
7. Drum
8. Separation pawls
9. Cleaning blade
10. Waste toner tank




- The AIO (All In One) cartridge combines toner, toner supply mechanism, development mechanism, photoconductive drum, charge mechanism, development mechanism, and drum cleaning mechanism in a single unit.

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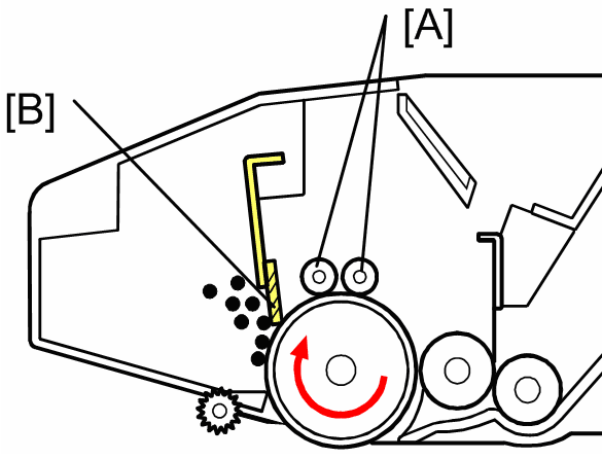
- The limiting factor for AIOs is toner.
  - The initial AIO that comes with the machine makes about 6k copies/prints.
  - The supply AIO makes about 25k copies/prints.

# Drum Charge and Cleaning




- **The dual charge rollers [A] give the drum surface a negative charge of approximately –900 V.**
- **The cleaning blade [B] removes any toner remaining on the drum's surface after image development and transfer.**

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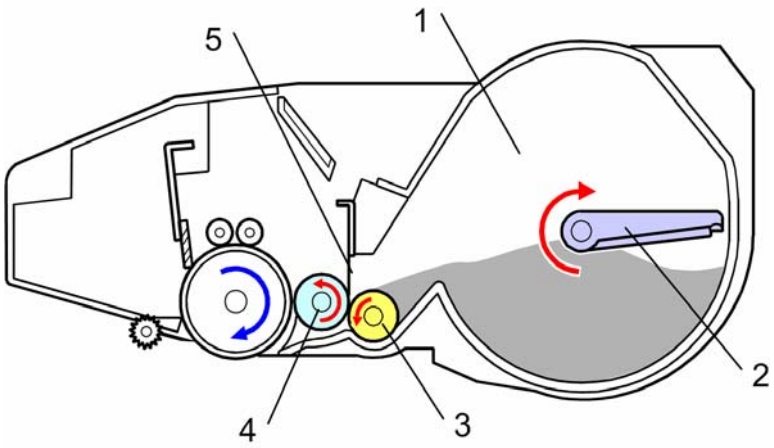
- The charge rollers are charged to -1550 V and they transfer -900 V to the drum.
- Cleaning blade is composed of polyurethane.
- Q: Why two charge rollers?
  A: Even with the cleaning blade the charge rollers will slowly get dirty. Design testing showed that two rollers are necessary to ensure sufficient charging for the life of the AIO under all environmental conditions.

# Toner Supply and Development




- **The toner tank (1) holds sufficient toner for the entire life of the AIO.**
- **The agitator (2) moves toner to the toner supply roller (3).**
- **The supply roller provides toner to the development roller (4).**
- **The metering blade (5) controls the amount of toner on the development roller.**
- **The toner on the development roller develops the latent image on the drum as it rotates past.**

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- The high voltage power supply applies the following:
  - -600V to the development roller
  - -1550V to the charge rollers
  - -110V to the supply roller
  - -490V to the metering blade
- The development components – drum, development roller, metering blade, and supply roller – are in contact. (= no photoconductor gap nor doctor gap.)
- Relative peripheral velocities: OPC  1, Development roller 1.2, Charge roller more than 1.2
- This AIO uses mono-component toner. Therefore, no toner density sensor or image density sensor is required.
- The toner is negatively charged.

# Toner Near-end and Toner End Detection

- **This machine detects toner near-end and toner end as follows:**
- **Toner Near-end**
  - A toner-end sensor, mounted on the left frame of the machine, checks for a low-toner condition.
  - If the toner end sensor is activated ten times in a row, the toner near-end condition exists.
- **Toner End**
  - When the toner near-end condition occurs, the machine starts the toner-end count.
  - Toner End is based on dot count. After toner consumption equivalent to 1,250 A4 prints/copies at 5% coverage, the toner end condition is achieved.

(See the detection mechanism on the next two slides.)

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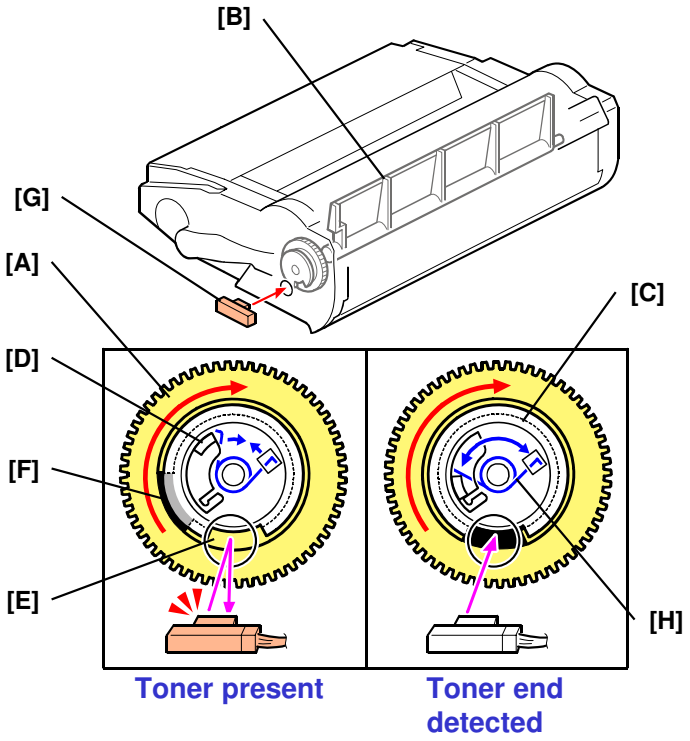
**No additional notes.**

# Toner End Detection Mechanism – 1

- The agitator gear [A] drives the agitator [B] through the shutter plate [C].
- Toner present:
  Toner resists the agitator, preventing it from turning until the tab [D] of the gear contacts the shutter plate. The gap [E] in the shutter plate does not align with the hole [F] in the gear; so, light is reflected back to the toner end sensor [G].
- Toner near-end:
  There is low resistance to the rotation of the agitator. The torsion spring [H] causes the gap of the shutter plate to align with the hole in the agitator gear. Light is not reflected back to the sensor.

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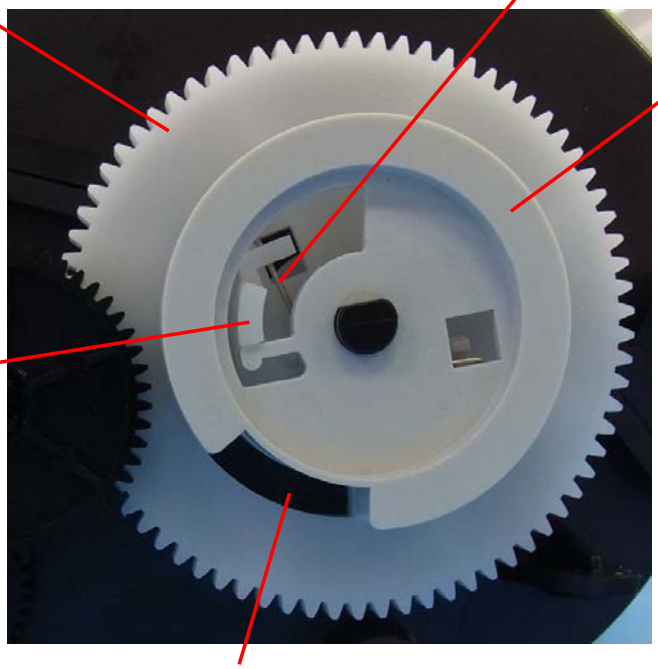
See next slide.

- Toner near-end + about 1,250 prints = Toner end

# Toner End Detection Mechanism – 2

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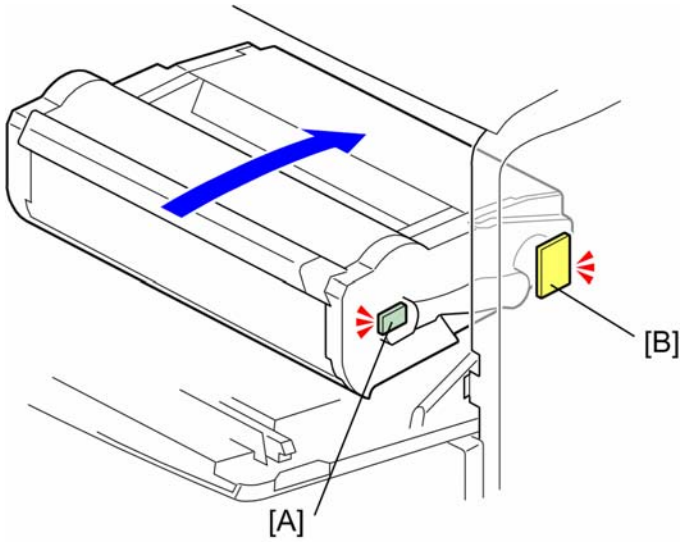
**No additional notes.**

# RFID

- The AIO has a RFID IC [A]. The RFID stores some data which can be checked by SP mode. (SP 7-931 – see next slide.)
- This data is used to calculate the amount of toner remaining in the toner tank.
- The RFID chip is also used to detect whether the cartridge is installed.
- The RFID chip transmits & receives data to/from the RFID board [B].

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- RFID = Radio Frequency Identification
- This small RFID is not just a tag. It stores information that allows the AIO to be transferred to another machine. (Access the RFID data via SP7-931-1 to SP7-931-23.)

# SP7-931 Data

| Stored Data | SP Number |
|---|---|
| Machine ID | SP 7-931-001 |
| Version | SP 7-931-002 |
| Brand ID | SP 7-931-003 |
| Area ID | SP 7-931-004 |
| Class ID | SP 7-931-005 |
| Color ID | SP 7-931-006 |
| Maintenance ID | SP 7-931-007 |
| New AIO | SP 7-931-008 |
| Recycle Count | SP 7-931-009 |
| EDP Code | SP 7-931-010 |
| Serial Number | SP 7-931-011 |
| Remaining Toner | SP 7-931-012 |
| Toner End | SP 7-931-013 |
| Refill Flag | SP 7-931-014 |
| R: Total Counter | SP 7-931-015 |
| E: Total Counter | SP 7-931-016 |
| Unit Output Counter | SP 7-931-017 |
| Install Date | SP 7-931-018 |
| Toner End Date | SP 7-931-019 |
| Conductor Time 1 to 4 | SP 7-931-020 to -023 |

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**No additional notes.**

# Fusing and Paper Exit

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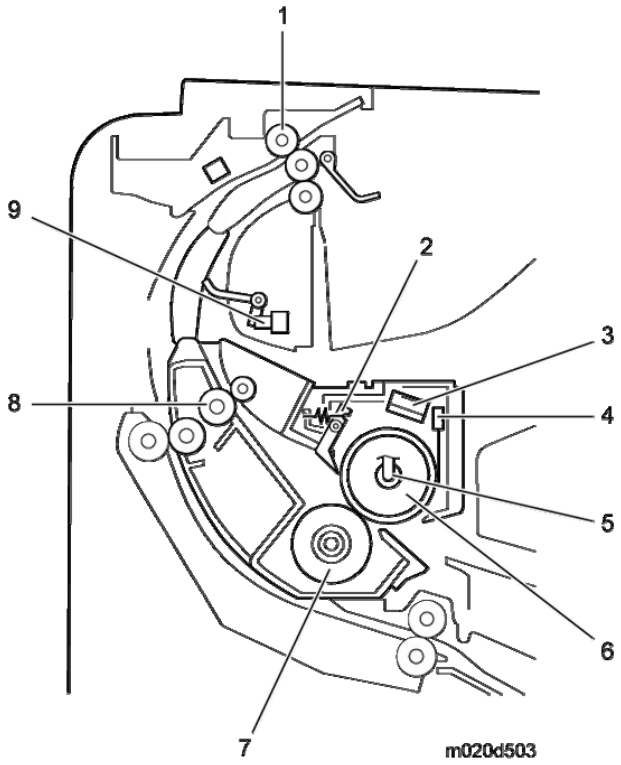
**No additional notes.**

# Fusing Overview

1. Paper exit roller
2. Hot roller strippers
3. Thermostat
4. Thermistor
5. Fusing lamp
6. Hot roller
7. Fusing pressure roller
8. Fusing exit roller
9. Paper exit sensor




- The hot roller and pressure roller fuse the toner image to the paper.
- After fusing, the paper passes through the fusing exit rollers and the paper exit rollers to the output tray. (See the Paper Exit section.)

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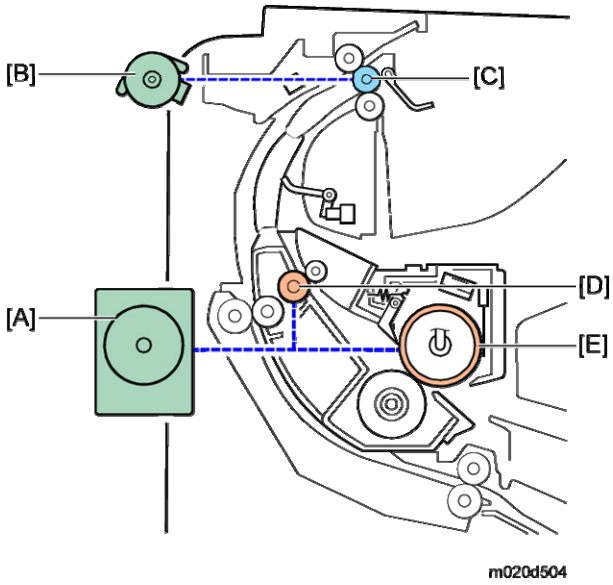
- The thermistor detects the temperature of the hot roller. (See the "Fusing Temperature control" slide.)
- The thermostat provides backup overheat protection.

# Fusing Drive




- The main motor [A] drives the hot roller [E] and the fusing exit rollers [D].
- rollers [C] through a clutch [B] a gear train.

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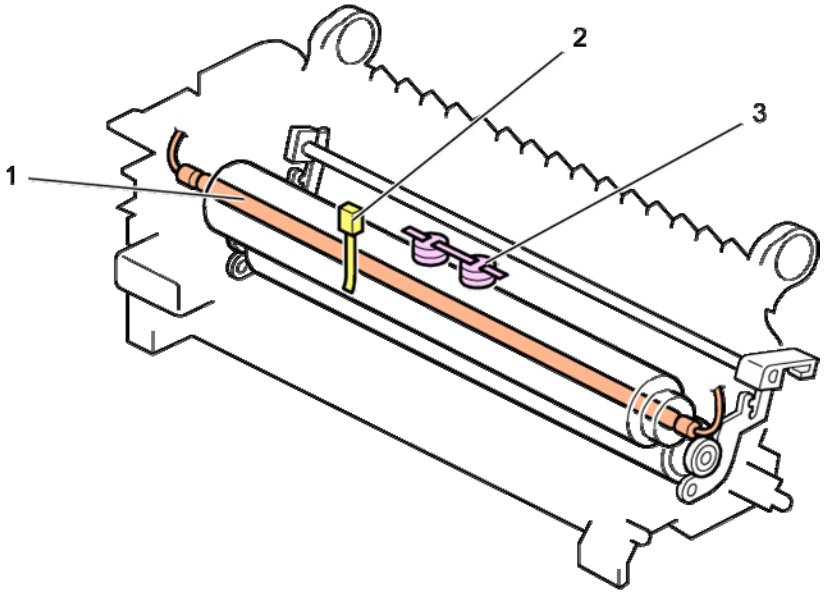
**No additional notes.**

# Electrical Components

1. Fusing lamp
2. Thermistor
3. Thermostats

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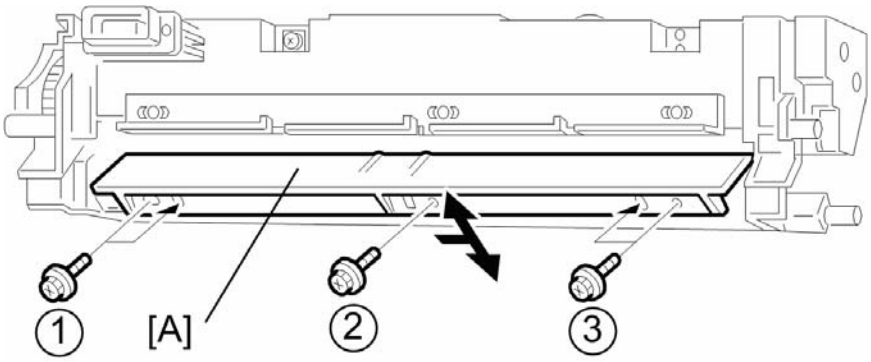
**No additional notes.**

# Fusing Entrance Guide Adjustment




- The entrance guide [A] is adjustable for paper thickness to prevent creasing.
- If creasing occurs frequently in the fusing unit, remove all three screws and slide the entrance guide to the right. Replace the two end screws only. Do not replace the middle screw.
- This procedure allows paper to have more direct access to the point where the hot roller and the pressure roller meet.

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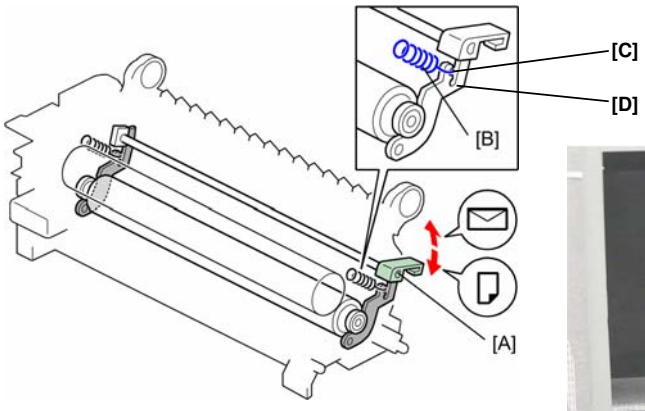
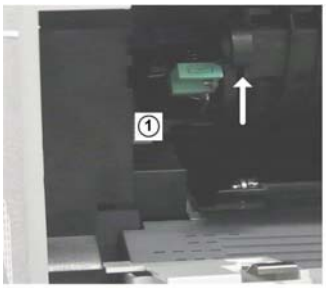
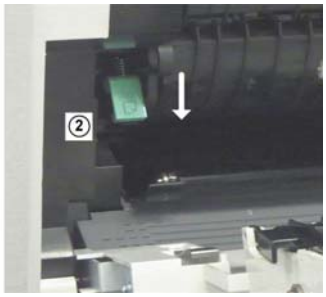
**No additional notes.**

# Fusing Pressure Adjustments




- **Service Adjustment**
  - To increase fusing pressure move the pressure springs [B] from the upper notch [C] to the lower notch [D].
- **User Adjustment for Envelopes**
  - The user can change the fusing pressure with the envelope lever [A]. Less pressure is needed for envelopes, which are thicker than normal paper.
  - Raise the lever (①) to reduce the pressure. This prevents jams and wrinkling when printing on envelopes.
  - Lower the lever to (②) return pressure to normal for all other print jobs. Normally this lever should be down.

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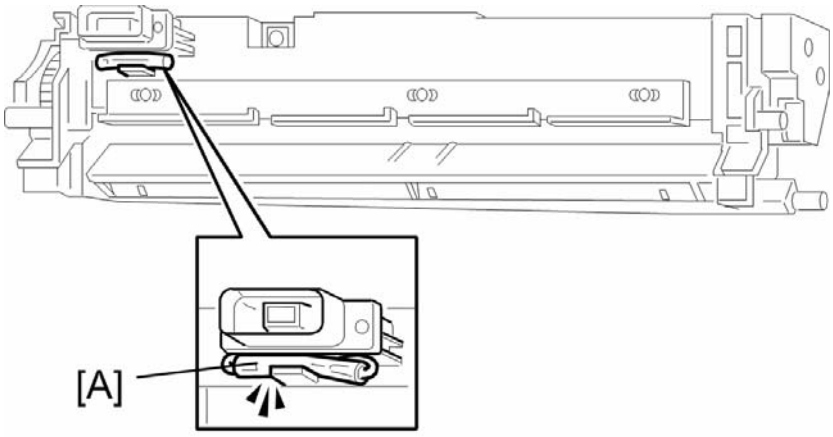
- You may need to increase pressure if the customer complains of insufficient fusing. The factory setting is the upper notch.

# New Fusing Unit Detection




- In a new fusing unit, the looped wire on the fusing unit connector contains a fuse [A].
- When power is switched on after installing a new fusing unit, the engine board detects the fusing unit through the looped wire. However, the fuse opens very shortly afterwards.

(Also, see slide 27.)

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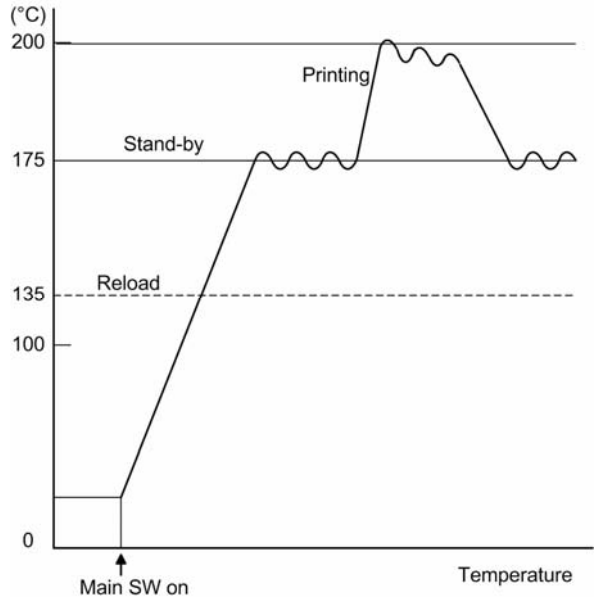
**No additional notes.**

# Fusing Temperature Control

- When the main switch turns on, the CPU turns on the fusing lamp using the soft start process. (The soft start process prevents the room lights from flickering.)
- The lamp stays on until the thermistor detects the standby temperature.
- Then the CPU maintains this temperature using on-off control.
- At the start of printing, the CPU raises the fusing temperature to the printing temperature.

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- At the "Reload" temperature, the user can start job input.

# Overheat Protection

- If the hot roller temperature becomes greater than 235°C, the CPU cuts off the power to the fusing lamp. At this time, SC543 will be generated.
- If the thermistor overheat protection fails, there are thermostats in series with the common ground line of the fusing lamp. If the temperature of a thermostat becomes greater than approximately 175°C, the thermostat opens, removing power from the fusing lamp. At this time, the machine stops operation.

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**No additional notes.**

# Energy Saver Mode

- **When the machine is not being used, the energy saver feature reduces power consumption by switching off the fusing lamp.**
- **Entering Energy Saver Mode**
  - Energy saver mode starts after the machine has been idle for a specified time. The operator can set the time on the System menu. ([Menu] > "System"]. Several settings are available: Off, 1, 5, 15, 30, 45, 60 min (Default: 5 min.)
  - When the machine is in energy saver mode, the CPU turns off the fusing lamp. The +5VE (power enabled in energy saver mode) line is active in energy saver mode; however, the +24V and +5V lines are not active.
- **Leaving Energy Saver Mode**
  - The machine leaves energy saver mode when one of the following events occur:
    - » Print command received from the PC
    - » Any cover opened and closed
    - » Any operation panel keys pressed

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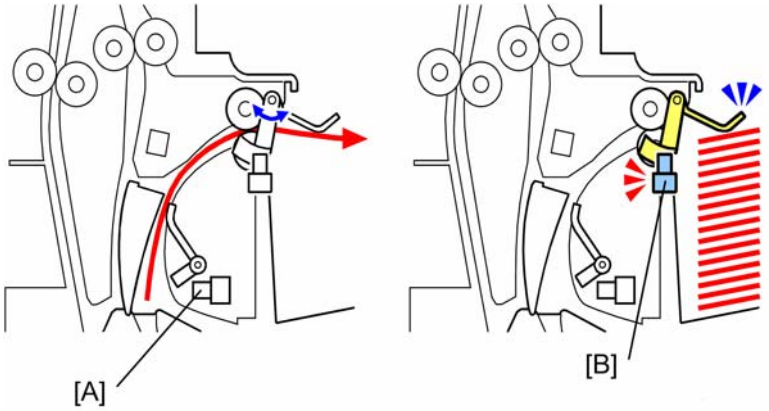
**No additional notes.**

# Paper Exit




- The paper exit sensor [A] detects paper misfeeds.
- When the paper overflow sensor [B] is activated, the machine detects that the paper stack height limit has been reached and stops printing.

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**No additional notes.**

# Duplex

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**PURPOSE OF THE SECTION**

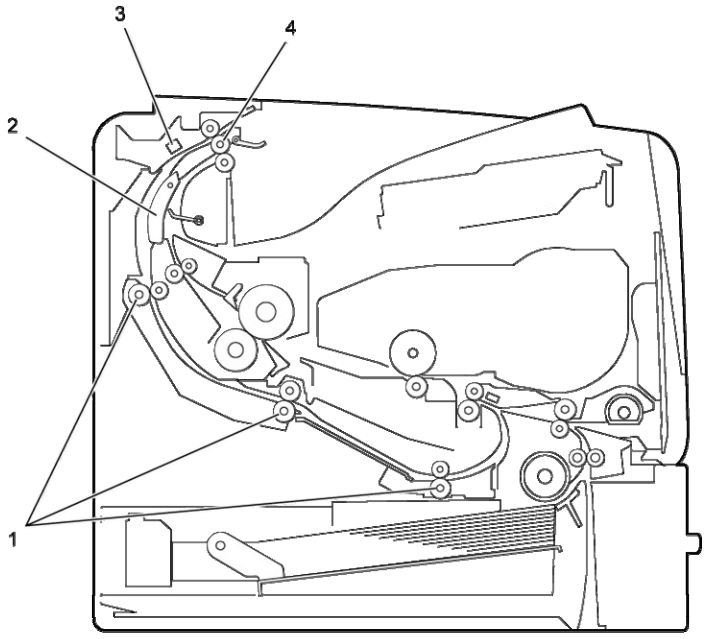
**In this section you will:**

- ❒ Learn how paper is fed in duplex mode.

# Components and Basic Operation

1. Duplex transport rollers
2. Junction gate
3. Duplex entrance sensor
4. Paper exit rollers

- To print on the second side, the paper from the fusing unit is directed above the paper exit rollers [4].
- The paper exit rollers reverse and feed the paper to the duplex transport rollers, which feed the paper back to the registration rollers with the reverse side up.
- When both sides have been printed, the paper goes under the paper exit rollers to the output tray.

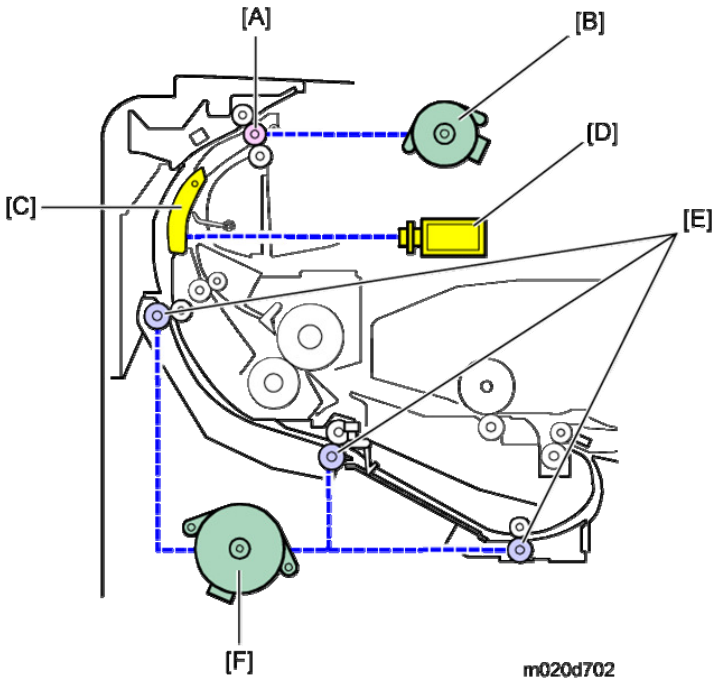



Slide 87

**No additional notes.**

# Duplex Drive

- The paper exit motor [B] drives the paper exit rollers [A]
- The duplex motor [F] drives the duplex transport rollers [E]
- The duplex junction solenoid [D] controls the junction gate [C]

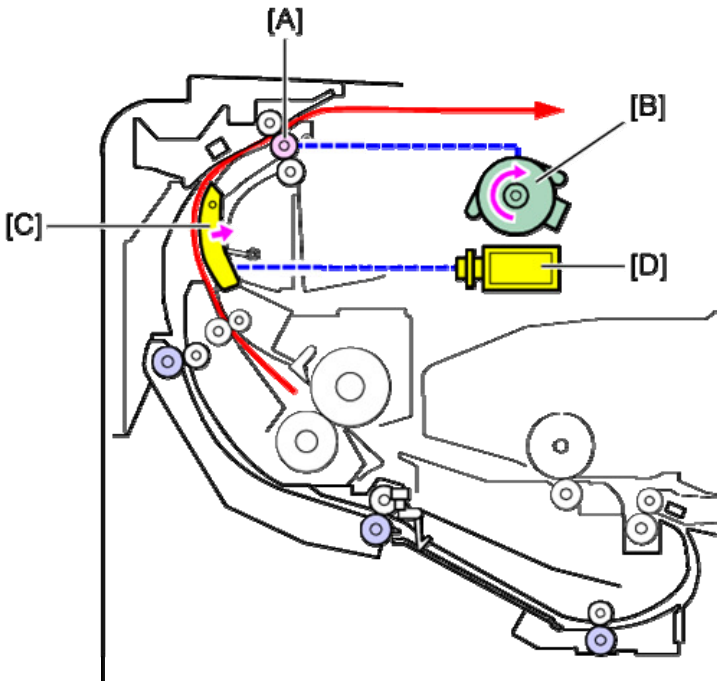



Slide 88

**No additional notes.**

# Inverter Mechanism – 1

- When a duplex job is sent to the machine, junction gate solenoid [D] moves the junction gate [C] and opens the paper path to the inverter section.
- The sheet of paper is fed above the exit rollers [A], which are driven clockwise by the paper exit motor [B] at this time.

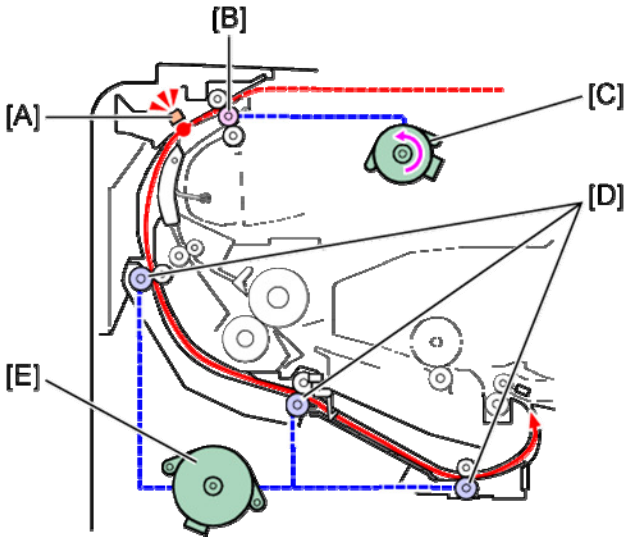



Slide 89

**No additional notes.**

# Inverter Mechanism – 2

- When the duplex inverter sensor [A] detects the trailing edge of paper, the paper exit motor [B] reverses. The paper is switched back, and fed to the duplex path.
- The paper is transported by the duplex transport rollers [D] which are driven by the duplex motor [E].
- The paper arrives at the registration rollers with the reverse side up. The junction gate solenoid turns off.
- After an image is printed and fused on the reverse side, the paper goes to the paper exit. The paper exit rollers are rotating counterclockwise; so the paper goes to the output tray.

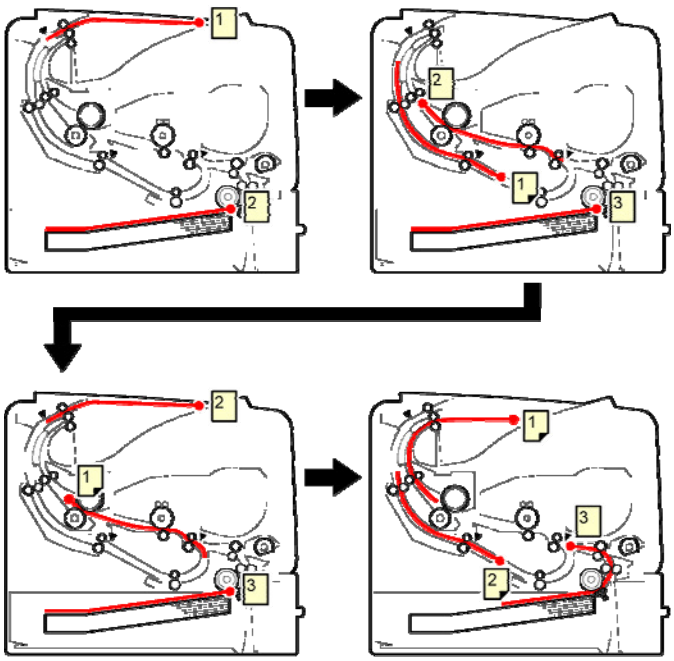


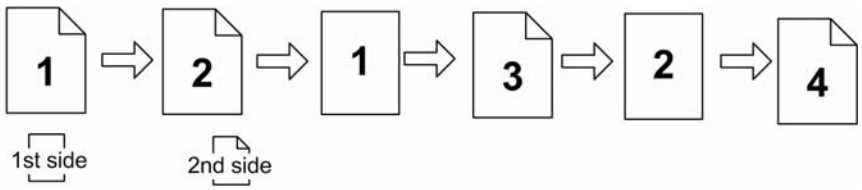

Slide 90

**No additional notes.**

# Interleave Operation

- Up to three sheets of paper in the paper feed path at the same time. The interleave method is used.
- The illustration to the right shows how the paper travels through the machine during duplex copying.
- The illustration below shows image printing sequence.






Slide 91

❒ For each sheet, the second side image is printed first so that the sheets will be stacked in the proper order on the output tray.

# Optional Paper Tray Units (M386, M389)

Slide 92

- This section will cover only the items that are unique to the paper tray units.
- The components and feed mechanism are basically the same as for the standard paper tray.

# Overview

- Each paper tray unit (PFU) has its own feed mechanism.
- Like the standard tray, each PFU holds 550 sheets of paper.
- If the machine is installed on the floor, the bottom PFU must be a TK1130 (M376) unit (Has casters)
- The paper trays are almost exactly the same as the standard paper tray. The only difference is that the front plate is slightly higher on the PFU trays.

PFU Tray Standard Tray

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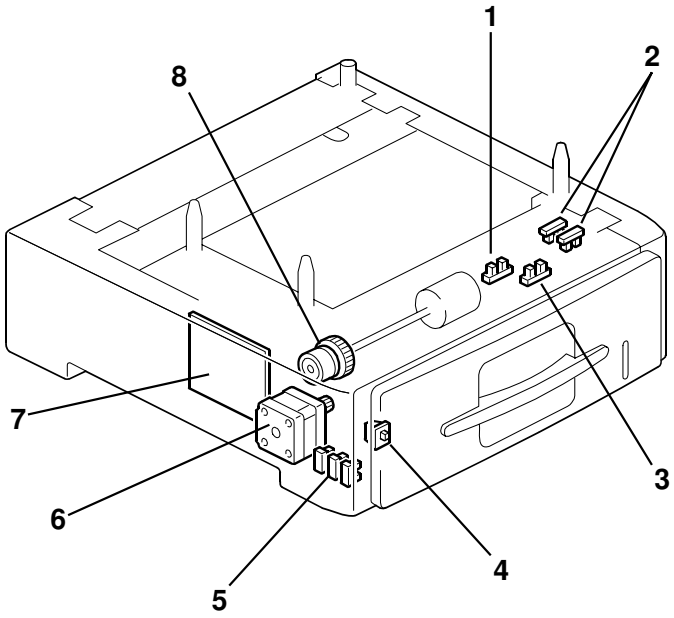
# Electrical Component Layout

1. Paper end sensor
2. Remaining paper sensors
3. Transport sensor
4. Tray set switch
5. Paper size detection sensor
6. PFU motor
7. PFU board
8. Feed clutch

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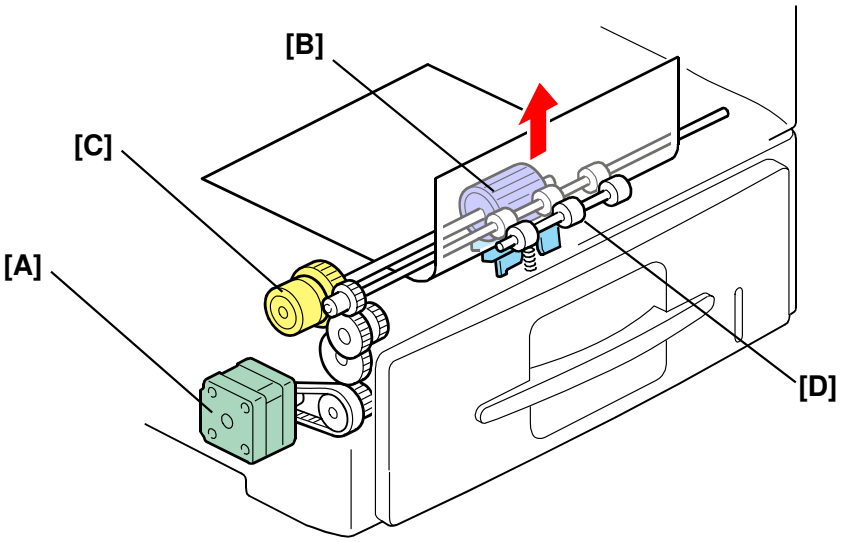
❒ Components 3, 6, 7, and 8 are unique to the paper tray units.

# Paper Feed Drive




- The paper feed motor [A] drives the feed roller [B] via a timing belt, gears, and the feed clutch [C].
- The transport rollers [D] direct the paper to the main unit.

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**No additional notes.**

RICOH

# Environmental Conservation

## Technology for Environmental Conservation

## Energy Saving

## Paper Saving

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❒ 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 | SH-MF1/ SH-P1 |
|---|---|---|
| 1. QSU | - Reduction of warm-up time (Energy saving)<br>- 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.<br>- 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<br>- 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 | | |

The shaded parts of the chart are not applicable as this machine uses an AIO.

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❒ 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.

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**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.

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**No additional notes**

# Brief Descriptions of the Technologies

- **5. High-speed duplex output**
  - Enables high-speed duplex printing through the utilization of the Duplex Interleaf and high-speed Inverter Transport features.
- **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

Slide 100

**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.

Slide 101

**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.

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**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.

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**No additional notes**

# Quick Start-up

- **The warm-up time and recovery time from sleep mode are as follows.**
  - Warm-up time (20 seconds)
  - Recovery time
    - » Sleep Mode:
      - – 20 seconds

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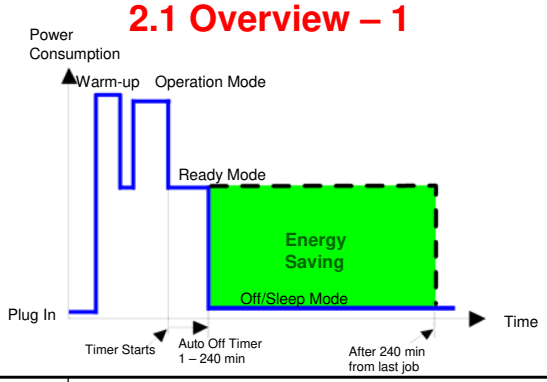
- Through major reductions in warm-up time and recovery time from energy saver modes (Low power, Sleep), QSU (Quick Start Up) Technology has eliminated the traditional trade-off between energy saving and convenience of speed.

# 2. Energy Saving

## 2.1 Overview – 1




| Energy Saver Modes | Description |
|---|---|
| Auto Off Mode | If no printer/scanner or fax unit is installed:<br>No power is supplied to the printing engine and the controller. |
| Sleep Mode | When a printer/scanner or fax unit is installed:<br>No power is supplied to the printing engine, and almost none to the controller. |

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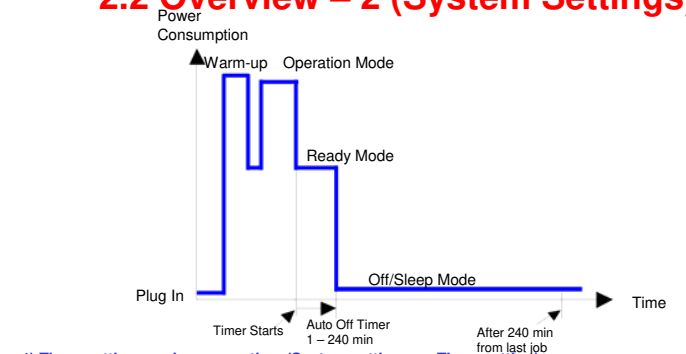
- When the machine is not being used, the machine enters energy saver mode to reduce the power consumption by turning off the LCD of the operation panel and lowering the fusing temperature.
- The area shaded green in this diagram represents the amount of energy that is saved when the timers are at the default settings. If the timers are changed, then the energy saved will be different. For example, if the timers are all set to 240 minutes, the green area will disappear, and no energy is saved before 240 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 |
|---|---|---|---|---|
| Off/Sleep Mode | Auto Off Timer | 1min | 1 to 60 min. | 20 sec. |

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- The user can set these timers with User Tools
  MFP/ Priport: User Tools > System settings > Timer Setting
  Printer : User Tools > System settings > Energy Saver Timer
- Normally, Panel Off timer < Energy Saver timer < Auto Off timer.
- But, for example, if Auto Off timer < or = Panel Off timer and Energy Saver timer, the machine goes immediately to Off mode when the Auto Off timer expires. It skips the Panel Off and Energy Saver modes.
- Example
  - Panel off: 1 minute Low power: 15 minutes, Auto Off: 1 minute
  - The machine goes to Off mode after 1 minute. Panel Off and Low Power modes are not used.
- 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: Condition of LEDs

❑ **Condition of LEDs on the operation panel**

| Mode | Operation Switch LED | Energy Saver LED | Main Power LED |
|---|---|---|---|
| Off/Sleep Mode | Off | Off | On |

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**No additional notes**

# 2. Energy Saving

## 2.2 Energy Saver Mode: Sleep Mode –1

- **The machine enters sleep mode when one of the following is done.**
  - The auto off timer runs out after the last job.
  - The operation switch is pressed to turn the power off.
- **When the machine enters sleep mode, no power is supplied to the printing engine, and almost none to the controller.**
- **Recovery time**
  - Less than 20 seconds

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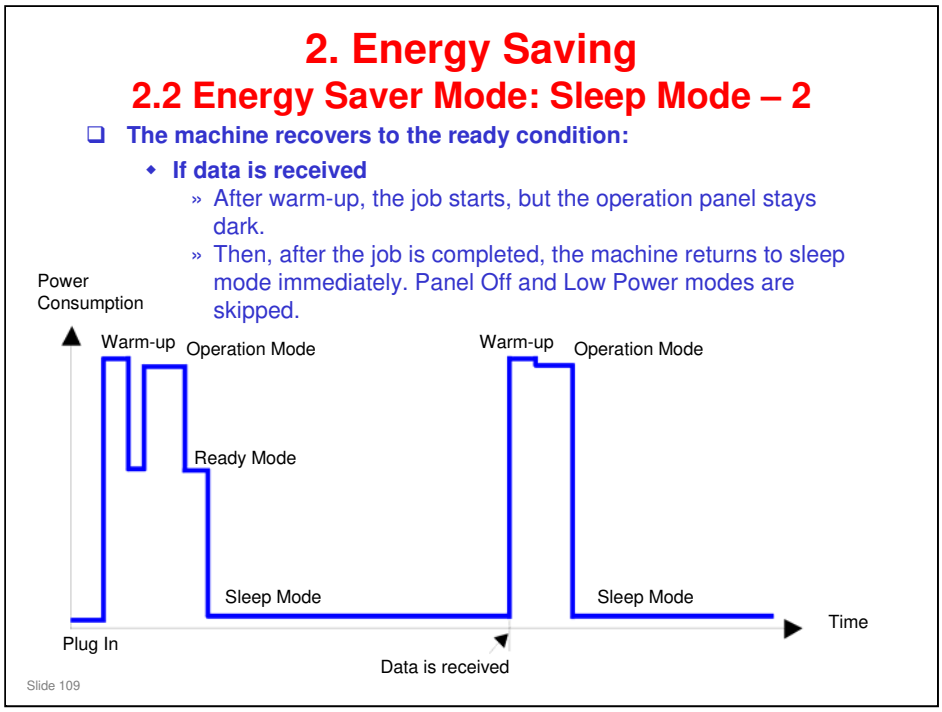
**No additional notes**

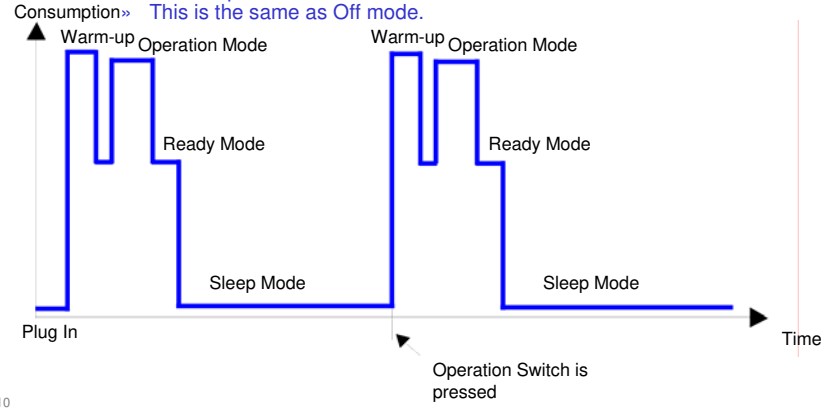



- This timing chart shows what happens if data is received while the machine is in sleep mode.
- Power consumption during warm-up may be much higher than shown in this diagram.

# 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.

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

# 2. Energy Saving

## 2.3 Energy Save Effectiveness – 1

- **With the data from SP 8941:Machine Status, and the power consumption values from the specifications, we can estimate the amount of energy that is used by the machine.**
  - 8941-001: Operating time
  - 8941-002: Standby time
  - 8941-003: Energy Save time
  - 8941-004: Low power time
  - 8941-005: Sleep mode time
- **This should only be used as a reference value, because the power consumption specifications are measured in a controlled environment with a constant power supply.**
- **To get an exact measurement at the customers site, a watt meter must be used to measure the actual energy consumed.**

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**No additional notes**

# 2. Energy Saving
## 2.3 Energy Save Effectiveness – 2

(1) At the start of the measurement period, read the values of SP 8941:001-005 (Machine Status), measured in minutes.

(2) At the end of the measurement period,read the values of SP 8941:001-005 (Machine Status), measured in minutes.

(3) Find the amount of time spent in each mode.
(Subtract the earlier measurement from the later measurement and convert the result to hours.)

(4) Power consumption figures for each model are acquired from "Publication System of MSDS_&_PEI (PRODUCT ENVIRONMENT INFORMATION)" database.

| Mode/condition | Power consumption: |
|---|---|
| Operating mode | SH-P1a: 787 W<br>SH-P1b: 834 W |
| Standby mode | SH-P1a: 160 W<br>SH-P1b: 161 W |
| Sleep mode | SH-P1a: 2.88 W<br>SH-P1b: 3.14 W |


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❒ Power consumption values are based on the main unit only without optional paper tray units.

# 2. Energy Saving

## 2.3 Energy Save Effectiveness – 3

**(5) Multiply this by the power consumption spec for each mode and convert the result to kWh (kilowatt hours)**

**(6) This is a simulated value for power consumed.**

**Example calculations (SH-P1b):**

| Mode/condition | SP8941: Machine Status | Time at Start (min.) (1) | Time at End (min) (2) | Running time (hour) (2) – (1)/60 = (3) | Power Consumption Spec. (W) (4) | Power consumption (KWH) (3) x (4)/1000 = (5) |
|---|---|---|---|---|---|---|
| Operating | 001: Operating Time | 21089 | 21386 | 4.95 | 834.00 | 4.13 |
| Stand by (Ready) | 002: Standby Time | 306163 | 308046 | 31.38 | 161.00 | 5.05 |
| Sleep | 005: Sleep mode Time | 508776 | 520377 | 193.35 | 3.14 | 0.60 |
| Total (6) | | | | | | 9.78 |

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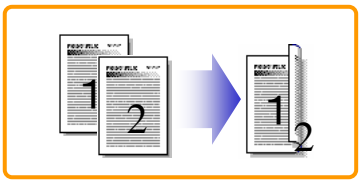
- Power consumption values are based on the main unit only without optional paper tray units.

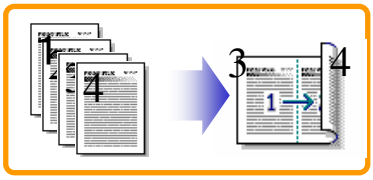
# 3. Paper Saving
## 3.1 Measuring the Paper Consumed – 1

1. Duplex: Reduce paper volume in half!




2. Combine: Reduce paper volume in half!


3. Duplex + Combine: Using both features together can further reduce paper volume by 3/4!




Slide 114

**No additional notes**

# 3. Paper Saving

## 3.1 Measuring the Paper Consumed – 2

- **To check the paper consumption, look at the total counter and the duplex counter.**
  - Total counter : SP 8581 001
  - Single-sided with duplex mode : SP 8421 001
  - Double-sided with duplex mode : SP 8421 002
  - Book with with duplex mode : SP 8421 003
  - Single-sided with combine mode : SP 8421 004
  - Duplex with combine mode : SP 8421 005
- **The total counter counts all pages printed.**
- **The duplex and combine counter counts all pages printed with duplex and combine mode.**

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**No additional notes**

# 3. Paper Saving

## 3.1 Measuring the Paper Consumed – 3

- **How to calculate the paper reduction ratio, when compared with Single-sided copying, with no 2-in-1 combine mode**
- **Paper reduction ratio (%) = Number of sheets reduced: A/Number of printed original images: B x 100**
  - Number of sheets reduced: A
  - = Output pages in duplex mode/2+ Number of pages in Single-sided with combine mode + Number of pages in Duplex with combine mode x 3/2
    A = (②+③+④)/2 + ⑤+⑥ x 3/2
  - Number of printed original images: B
  - = Total counter+ Number of pages in Single-sided with combine mode + Number of pages in Duplex with combine mode
    B = ①+⑤+⑥
    - **① Total counter : SP 8581 001 (pages)**
    - **② Single-sided with duplex mode : SP 8421 001 (pages)**
    - **③ Double-sided with duplex mode : SP 8421 002 (pages)**
    - **④ Book with with duplex mode : SP 8421 003 (pages)**
    - **⑤ Single-sided with combine mode : SP 8421 004 (pages)**
    - **⑥ Duplex with combine mode : SP 8421 005 (pages)**

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**In the above formula:**

- Sheet: A sheet of paper
- Page: A side of a sheet of paper. In duplex mode, one sheet is two pages
  - Output page: One side of a sheet of output paper
- Original Image: An image of one original page (or, an image of one side of a two-sided original)
  - For one sheet of output paper in two-in-one copying, four original pages are copied onto two output pages.