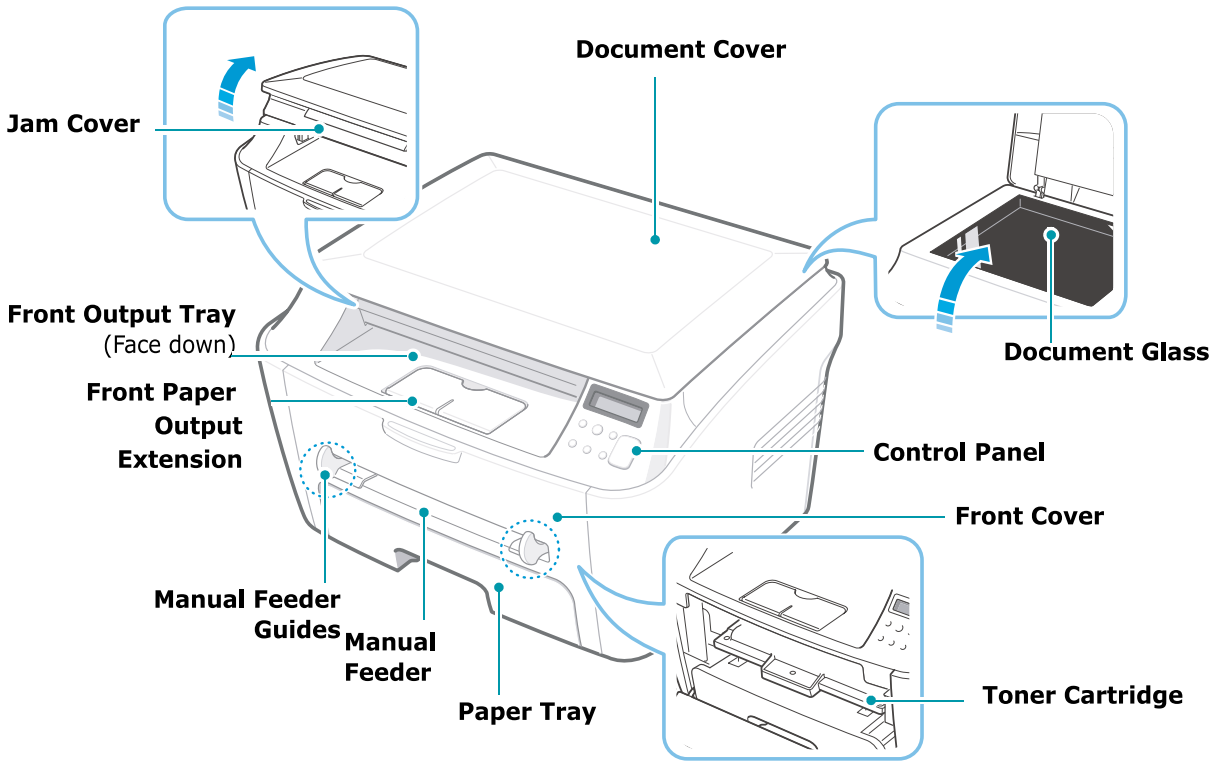
4. Summary of Product

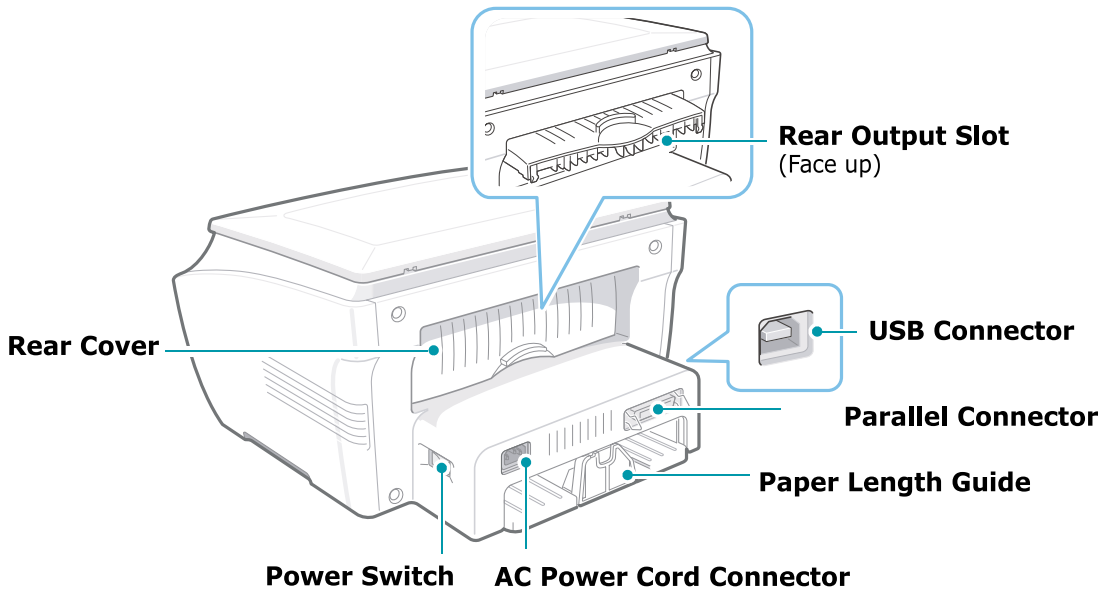
This chapter describes the functions and operating principles of the main component.

4.1 Printer Components

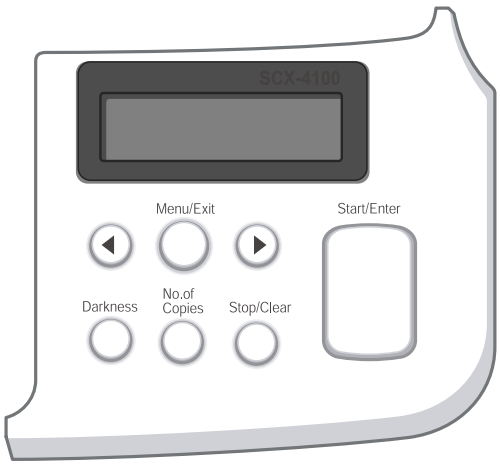
4.1.1 Front View



4.1.2 Rear View

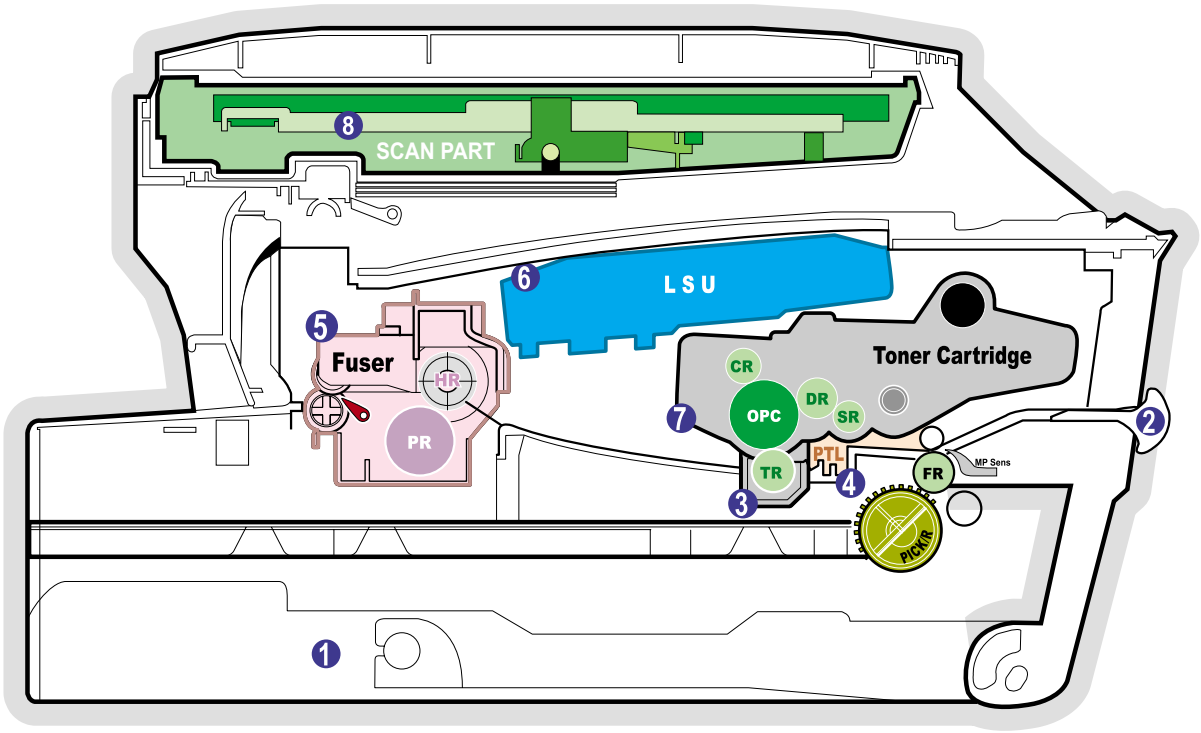


4.1.3 Control Panel



1 COPY	Darkness	Adjusts the brightness of the documents for the current copy job.
	No.of Copies	Selects the number of copies.
2	SCX-4100	Displays the current status and prompts during an operation.
3		Scrolls through the options available for the selected menu item.
	Menu/Exit	Enters Menu mode and scrolls through the menus available and sends you back to Standby mode.
4	Stop/Clear	Stops an operation at any time. In Standby mode, clears/cancels the copy options, such as the darkness and the number of copies.
5	Start/Enter	Confirms the selection on the display and starts a job.

4.2 System Layout



1. Cassette
2. Manual Feeder
3. Transfer Roller
4. PTL(Pre-Transfer-Lamp)
5. Fuser
6. LSU(Laser Scan Unit)
7. Toner Cartridge
8. Scan Unit

4.2.1 Paper Feed Mechanism

The printer has a universal cassette which automatically loads paper and a manual feed which supplies paper single sheet at a time. The cassette has a friction pad which separates paper to ensure single sheet feeding, and it has a sensor, which checks when the paper tray is empty.

- Feeding Method: Universal Cassette Type
- Feeding Standard: Center Loading
- Feeding Capacity: Cassette-250 sheets (75g/m2 , 20lb paper standard)
  Manual 1 sheet (Paper, OHP, Envelop, etc.)
- Paper detecting sensor: Photo sensor
- Paper size sensor: None

4.2.2 Transfer Ass'y

This consists of the PTL (pre-transfer lamp) and the Transfer Roller. The PTL shines a light onto the OPC drum. This lowers the charge on the drum's surface and improves transfer efficiency.
The transfer roller transfers toner from the OPC drum surface to the paper.

- Life expectancy: Over 60,000 sheets (at 15~30°C)

4.2.3 Drive Ass'y

A gear driven power unit. The motor supplies power to the paper feed unit, the fuser unit, and the toner cartridge.

4.2.4 Fixing Part(Fuser)

There are two types of fuser unit:

Q-PID type, developed by Samsung, and only used on 220V Domestic models
Heat Lamp type used on 220V Export models and all 110V models.

The Heat Lamp type fuser consists of the Heat Lamp, Heat Roller, Pressure Roller, Thermistor, and Thermostat. It fixes toner to the paper using pressure and heat to complete the printing job.

4.2.4.1 Heat Lamp power cut-off (Thermostat)

The thermostat is a temperature sensing device, which cuts off the power to the heat lamp to prevent overheating fire when the heat lamp or heat roller overheats.

4.2.4.2 Temperature Detecting Sensor (Thermistor)

The Thermistor detects the surface temperature of the heat roller, this information is sent to the main processor which uses this information to regulate the temperature of the heat roller.

4.2.4.3 Heat Roller

The surface of the Heat Roller is heated by the Heat Lamp. As the paper passes between the Heat and Pressure rollers the toner is melted and fixed permanently to the paper. The surface of the roller is coated with Teflon. This ensures that toner does not adhere to the roller surface.

4.2.4.4 Pressure roller

The Pressure Roller mounted under the heat roller, it is made of a silicon resin, and the surface of the roller is tubed with Teflon. This ensures that toner does not adhere to the roller surface.

4.2.4.5 Safety Relevant Facts

• To prevent overheating
  - 1st protection device: Hardware cuts off when overheated
  - 2nd protection device: Software cuts off when overheated
  - 3rd protection device: Thermostat cuts off mains power to the lamp.
• Safety device
  - Fuser power is cut off when the front cover is opened
  - LSU power is cut off when the front cover is opened
  - The temperature of the fuser cover's surface is maintained at less than 80ºC to protect the user and a caution label is attached where the customer can see it easily when the rear cover is opened.

4.2.5 Scanner Unit

• Scan Image Controller

1.Scan Line Time : 1.67ms
2.Scan Resolution : Color : Max 600DPI
3.Scan Width : 216mm
4.Function
  - White Shading Correction
  - Gamma Correction
  - CIS Interface
  - 256 Gray Scale

• CIS Driver Circuit

  - CIS Clock : 4.16MHz
  - Voltage Reference : 1.1V
  - CIS Line Time : 1.67ms/Line x 3Color(600dpi)

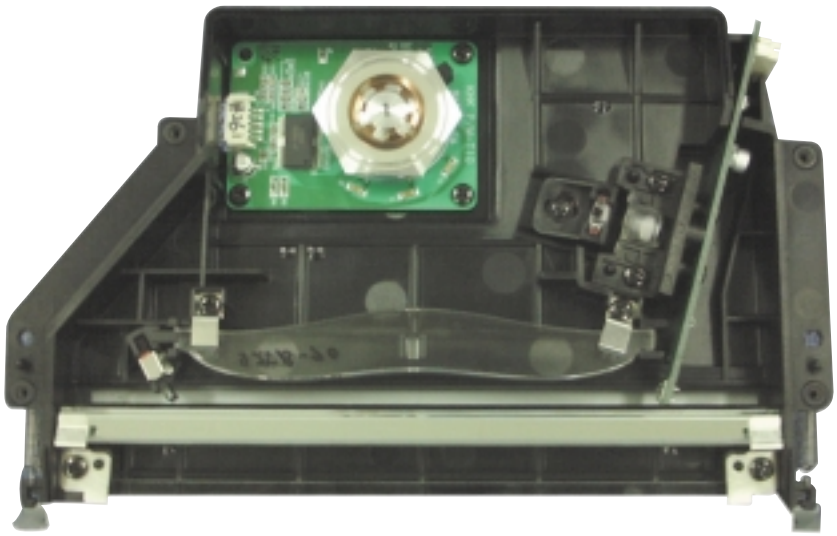
• Scan Motor Driver Circuit

  - Motor Driver : SIA403A
  - Used Volt : 24V DC

4.2.6 LSU (Laser Scanner Unit)

This is the core of the laser printer. It converts the video data received from the computer into an electrostatic latent image on the surface of the OPC drum. This is achieved by controlling the laser beam and exposing the surface of the OPC drum to the laser light. A rotating polygon mirror reflects the laser light onto the OPC and each side of the mirror is one scan line. The OPC drum turns as the paper feeds to scan the image down the page.

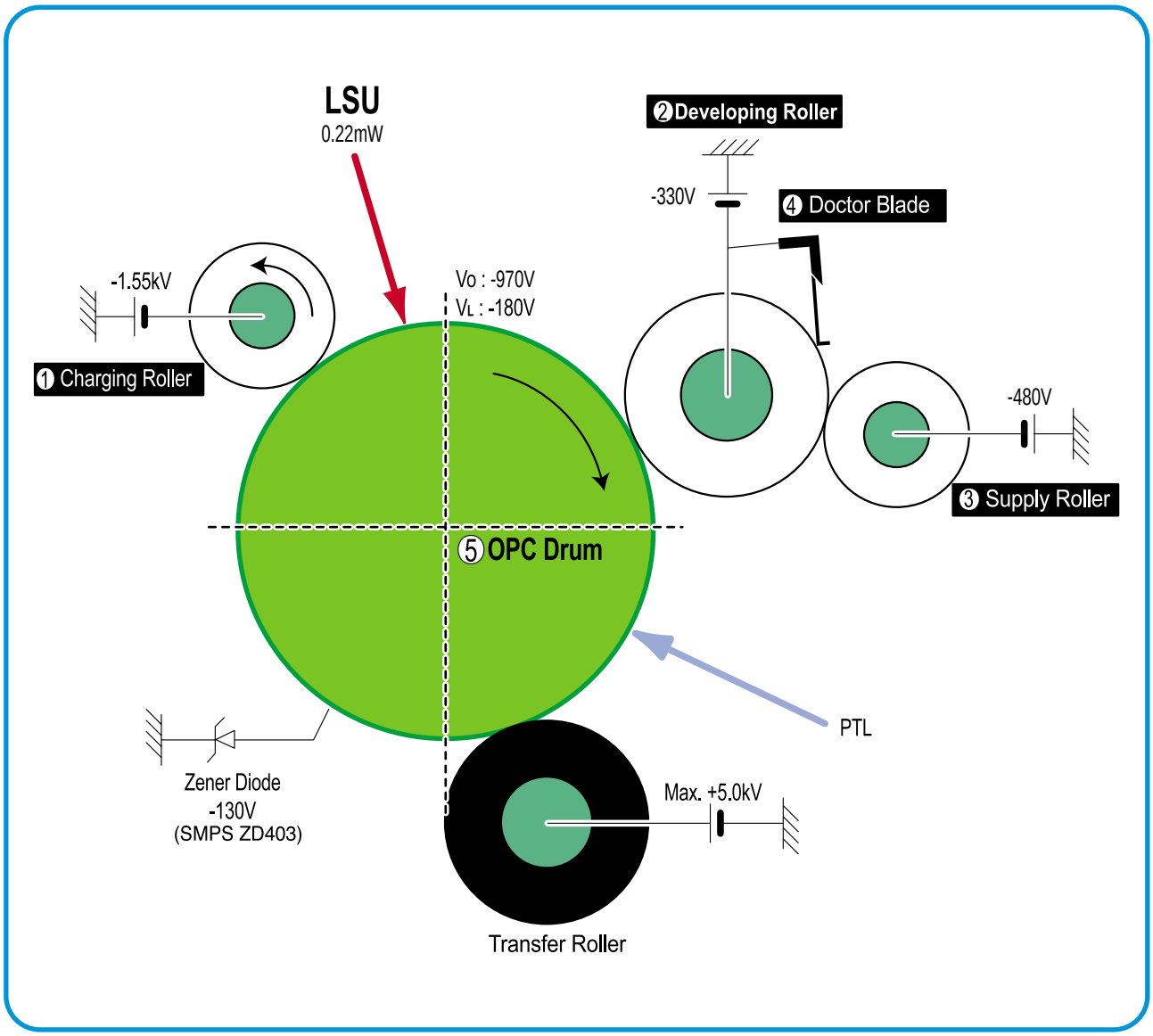
The /HSYNC signal is created when the laser beam from LSU reaches the end of the polygon mirror and this signal is sent to the controller. The controller detects the /HSYNC signal to adjust the vertical line of the image on paper. In other words after the /HSYNC signal is detected the image data is sent to the LSU to adjust the left margin on the paper.



4.2.7 Toner Cartridge

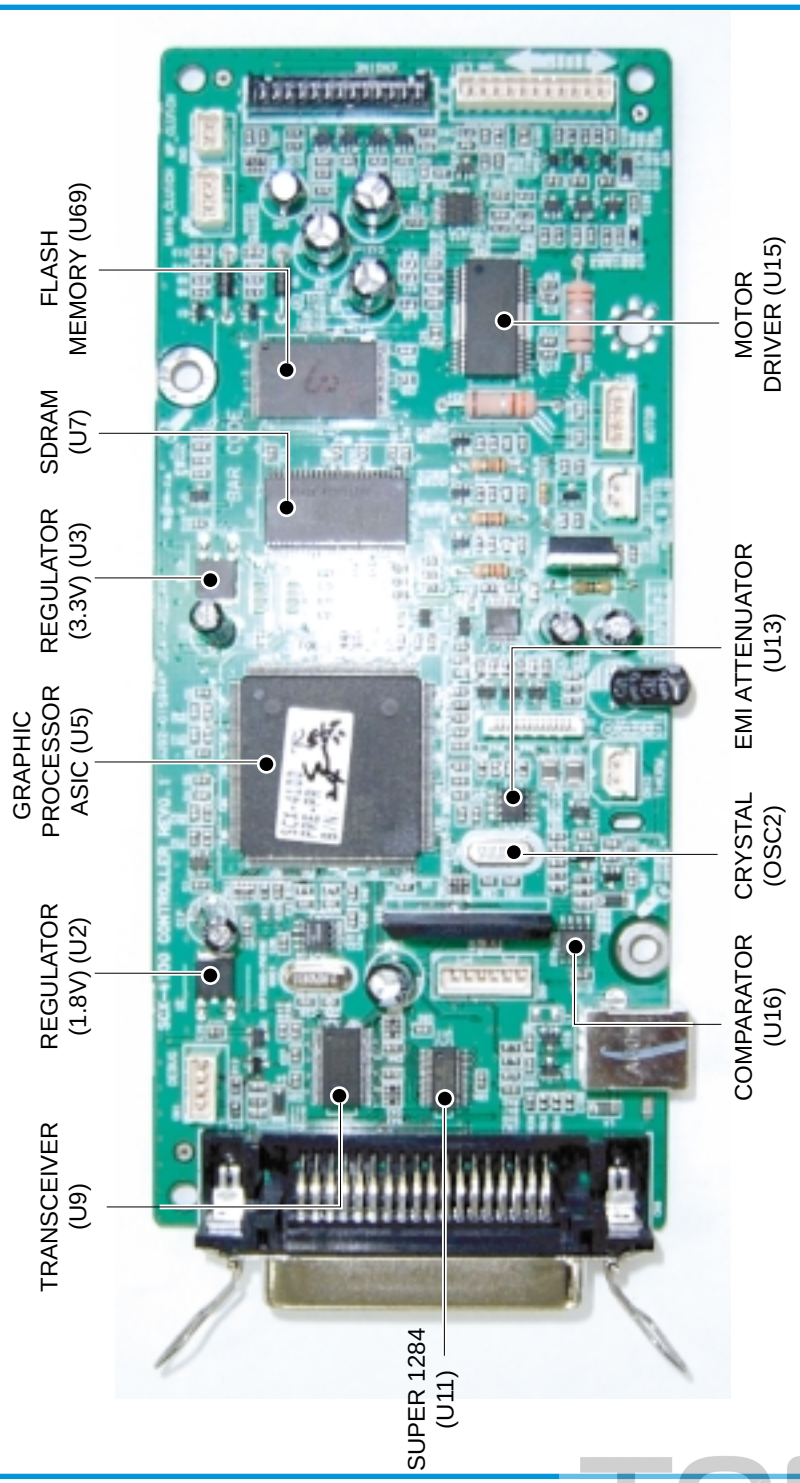
The toner cartridge is an integral unit containing the OPC unit and toner unit. The OPC unit consists of the OPC drum and charging roller, and the toner cartridge unit consists of the toner, supply roller, developing roller, and blade (Doctor blade)

- Developing Method: Non magnetic 1 element contacting method
- Toner: Non magnetic 1 element shatter type toner
- The life span of toner: 3,000 sheets (IDC Pattern/A4 standard)
- Toner remaining amount detecting sensor: No
- OPC Cleaning: Electrostatic process
- Management of waste toner: Electro static process(Cleanerless Type)
- OPC Drum protecting Shutter: No
- Classifying device for toner cartridge: ID is classified by interruption of the frame channel



4.3 Main PBA

The Engine Board and Controller Board have been integrated into a single PBA. This consists of the CPU, printer scanner and line control functions. The CPU functions as the bus controller, I/O handler, motor driver and PC inter-face. The main board sends the Current Image Video data to the LSU and manages the Electrophotographic printing process. Circuits on the PBA drive include the main motor (paper feed, cartridge, fuser), clutch driver, pre-transfer lamp driver, heat-lamp driver, CIS driver, scan motor driver and fan driver.
The signals from the paper feed jam sensor and paper empty sensor are inputted to the main board from the power supply PBA.



4.3.1 ASIC (Chorus2)

The Chorus2 (16Bit RISC Processor) ASIC is the main processor controlling the whole system. It controls all of the printing and scanning functions using a system program stored in flash memory.

•Main function block

- Completely Integrated System for Embedded Applications,
- 16/32 Bit Risc Architecture, Efficient and Powerful ARM7TDMI CPU
- LSU Interface Module for Interfacing PVC with LSU
- 5 Channel General Purpose DMA Controller for High Speed I/O
- Dual Memory Bus Architecture
- Operating frequency : 66MHz
- Operating power : 1.8V(internal), 3.3V(external)

4.3.2 Flash Memory

This stores the system program. Firmware upgrade is achieved by downloading from the new image using the PC Interface.

- Capacity : 1M Byte
- Access Time : 70 nsec

4.3.3 SDRAM

This is used as a buffer, system working memory area, etc. while printing and scanning.

- Capacity :

SCX-4100
8 M byte

- Access Time : 15 nsec

4.3.4 Sensor input circuit

1) Paper Empty Sensing

The Paper Empty sensor (Photo Interrupter) on the SMPS/HVPS PBA is monitored by the CPU.
When the cassette is empty the printer displays a message on the LCD panel.

2) MP Sensing

Presence of paper in the MP tray is detected by operation of the MP Sensor (Photo Interrupter) on the SMPS/HVPS PBA. The CPU monitors this signal to recognize paper in the MP, and paper is fed from MP if there is paper present.

3) Paper Feeding, Toner Cartridge Sensing

When paper passes the actuator on the feed sensor, it is detected by the Photo interrupter.
Signal (nP_FEED, PIN 186) monitored by the CPU and this signal starts the process of creating the image after certain delay time If the feed sensor is not detected within 1 sec. after paper is fed, a paper Jam0 occurs. (Displayed on the LCD panel).
When a toner cartridge is inserted it also operates the Paper Feed sensor. A message is displayed on the LCD id no cartridge is detected.

4) Paper Exit Sensing

This detects that paper exits cleanly from the set using an exit sensor on the engine board and actuator on the frame. The monitors signal (P_EXIT, PIN 84) and detects the on/off time of the exit sensor and if jam status is detected then JAM2 is displayed the on the LCD panel.

5) Cover Open Sensing

The Cover open sensor actuator is located on the front cover and the senor is in the main frame.
When the front cover is open the +24V and +5V supplies to the DC fan, solenoid, main motor, polygon motor part of LSU, HVPS and LSU Laser diode are cut off. The CPU monitors signal (COVER_OPEN, GPIO_11) to recognize when the cover is open.

6) DC FAN / SOLENOID Driver

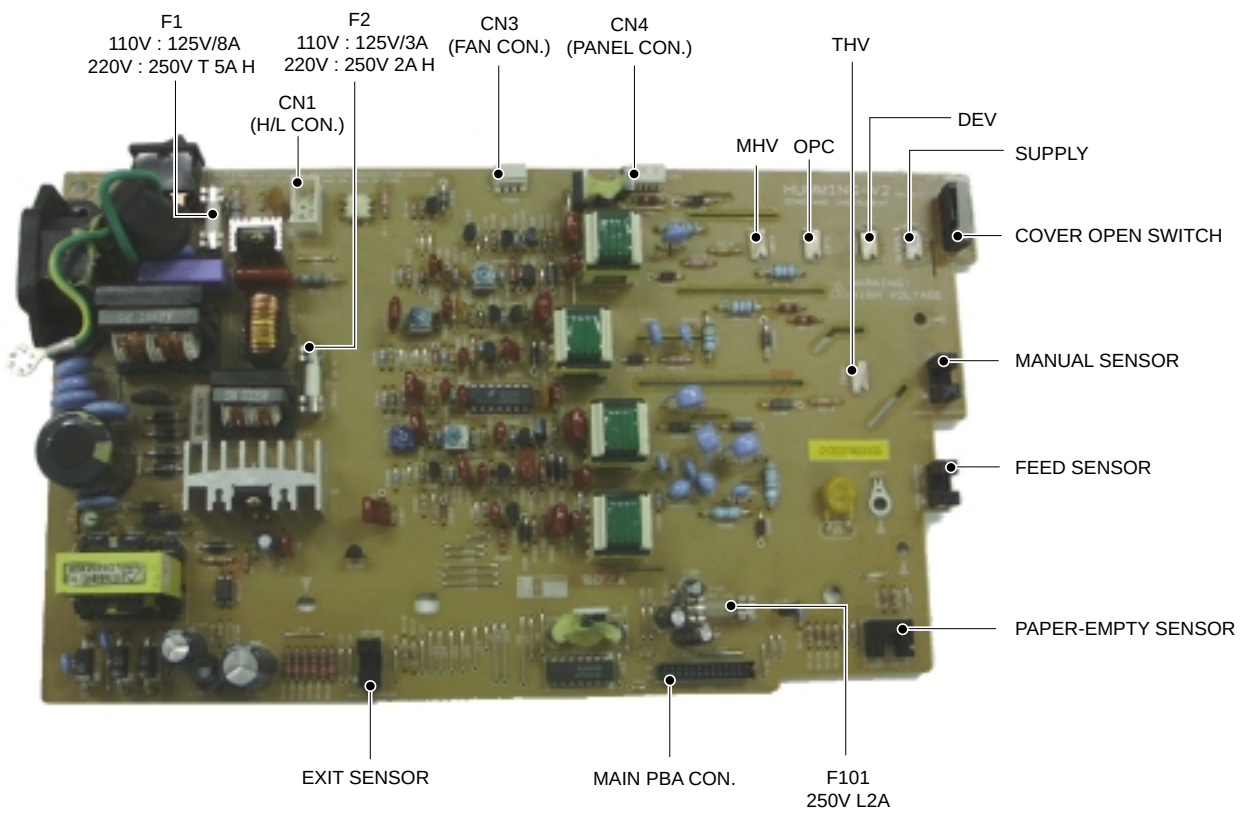
It is driven by a transistor and controlled by signal (FAN, GPIO_7; Main Clutch Solenoid:PIN 185,MP Clutch Solenoid: PIN 184) bit of the CPU.
When it is high the fan is activated by turning on the TR, and it is off when the sleep mode is selected. There are three solenoids and these are driven by the Paper Pick-up, Regi and MP signals. The diode protects the driving TR from the Back-EMF pulse which is generated when the solenoid is de-energized.

7) Motor Driver

The motor driving circuit is activated when the Driver IC is enabled. An AN44060 (Motor driver IC) is used in this case. The resistance Rs value of sensing and the voltage value of the V reference can be changed by the motor driving voltage value.

4.4 SMPS & HVPS

The SMPS and HVPS are on one integrated board.
The SMPS supplies the DC power to the system. It takes either 110V or 220V and outputs the +5V and 24V supplies to the main and other PBAs.
The HVPS creates the high voltage of THV/MHV/Supply/Dev and supplies it to the toner cartridge. The CPU is used to modify some of these voltage settings to provide the ideal voltages to create the image.
The HVPS part uses the 24V and outputs the high voltage for THV/MHV/BIAS and the outputted high voltage is supplied to the toner, OPC cartridge and transfer roller.



4.4.1 HVPS(High Voltage Power Supply)

1) Transfer High Voltage (THV+)

- Function : It is this voltage that transfers toner from the OPC Drum to the paper.
- Output voltage : Maximum +5000V ±5% (no load, variable duty cycle)
- Error : IF THV (+) is not present, low density printing occurs due to toner on the OPC Drum not being transferred to the paper. It is possible that waste toner over-flow can occur if this condition persists. Ghost images may appear which repeat at 76mm intervals.

2) Charge Voltage (MHV)

- Function : It is this voltage that charges the surface of the OPC to -900V ~ -1000V.
- Output voltage : -1300V ~ -1800V DC ± 50V
- Error : IF MHV is not present toner then since the OPC drum surface has no charge toner is attracted to the whole OPC surface. A black page is printed out when this happens.

3)Cleaning Voltage (THV-)

- Function : It removes toner contamination from the rear side of the paper by sending (-) polarity to the transfer roller forcing toner to transfer back to the to OPC drum.
- Output Voltage : -1000VDC, +300V/-150V
- Error : Smudges and toner contamination on the reverse side of the printed page.

4) Developing Voltage (DEV)

- Function: It is this voltage that develops toner with on to the section of the OPC drum surface exposed by the LSU (Laser Scanning Unit).
  * When printing the exposed voltage on the OPC is -180V, unexposed is -970V, and the exposing voltage on the DEV is -330V. Therefore toner with (-) polarity is developed onto an exposed section of the OPC.
- Output voltage: -200V ~ 600V DC ± 20V
- Error: a) If DEV is GND, print density gets extremely low.
  b) When DEV is floating due to poor connection between the frame and cartridge contacts etc., print density gets extremely high.

5) Supply Voltage (SUP)

- Function: It is this voltage that supplies toner to the developing roller.
- Output voltage: : -350V ~ -750V DC ± 50V (Use ZENER)
- Error: a) When SUP is GND print density gets extremely low.
  b) If SUP is floating due to poor connection between the frame and cartridge contacts etc. density gets extremely low such that it is hard to see toner with the eyes

6) OPC Ground ZENER Voltage

- Function: It is this voltage that prevents image contamination under low temperature and low humidity environment conditions.
- When a set prints without an output voltage, -130V DC ± 15V is maintained on OPC ground. (-130V ZENER diode is connected to OPC ground)
- Error type: a) When the ZENER diode is - 0V there is no serious image problem in general environment, but in low temperature and low humidity environments it is possible that contamination can occur on the entire image
  b) When the ZENER diode is disconnected a blank page is printed out. (It is the same when a ZENER diode is disconnected from OPC ground.)

4.4.2 SMPS (Switching Mode Power Supply)

This is the power source for the whole system. It is an independent module so that it is possible to use it for common use. It is mounted at the bottom of the set.
It consists of the SMPS section, which supplies the DC power to drive the system, and the AC heater control part, which supplies the power to the fuser. The SMPS has four output channels (+5V, +3.3V, +3.3VS and +24VS). There are three kinds of power, 120V exclusive (America), 220V exclusive (Europe), and 220V for China (nations with unstable power supply).

1) AC Input

- Inputting rated voltage : AC 220V ~ 240V AC 100~127V
- Inputting voltage fluctuating range : AC 198V ~ 264V AC 90V ~ 135V
- Rated frequency : 50/60 Hz
- Frequency fluctuating range : 47 ~ 63 Hz
- Inputting Current : Under 4.0Arms/2.0Arms (when heat lamp is off)

2) Rated Power Output

NO	Item	CH1	CH2	CH3	Remark
1	Channel name	+5V	+24V	+24.0VS	
2	Connector Pin	CON 4 5V PIN: 3, 4, 23 GND PIN: 5, 6	CON 4 24V PIN : 14 GND PIN: 8, 9, 10	CON 4 24V PIN: 11, 12 GND : 8, 9, 10	
3	Rated Output Voltage	+5V ± 5% (4.75 ~ 5.25V)	+24V - 10/15% (21.6 ~ 27.46V)	+24VS - 10/15% (21.6 ~ 27.46V)	
4	Max. Output current	1.0 A	0.5A	1.0 A	
5	Peak Loading voltage	1.5 A	1.0A	1.5 A	1ms
6	Ripple noise voltage	Under 150m Vp-p	Under 500m Vp-p	Under 500m Vp-p	
7	Maximum output	5.0W	12W	24W	

3) Consumption Power

NO	Item	CH1 (+5V)	CH2 (+24V)	CH3 (+24VS)	System
1	Stand-By	0.2 A	0.07A	0.07 A	AVG : 60 Wh
2	PRINTING	1.0 A	0.5A	1.0 A	AVG : 300 Wh
3	Sleep-Mode	0.2A	0.02A	0.03A	AVG : 10 Wh

4) Length of Power Cord : 1830 ± 50mm

5) Power Switch : Fitted

6) Feature
- Insulation resistance : over 50M Ω (at DC500V)
- Insulation retest pressure : Must be no problem within 1min. (at 1500Vzc, 10mA)
- Leakage voltage : under 3.5mA
- Running voltage : under 40A peak (at 25°c, Cold start) Under 60A peak (in other conditions)
- Rise Time : Within 2Sec
- Fall Time : Over 20ms
- Surge : Ring Wave 6KV-500A (Normal, Common)

7) Environment Condition
- Operating temperature range : 0°c ~ 40°c
- Storage temperature range : -25°c ~ 85°c
- Storage humidity range : 30% ~ 90% RH
- Operating atmospheric pressure range : 1

8) EMI Requirement : CISPR ,FCC, CE, MIC, C-Tick,

9) Safty Requrement
- IEC950 UL1950, CSA950, C-UL,Semko,iK,CB, CCC(CCIB),GOST, EPA,

4.4.3 Fuser AC Power Control

The Fuser (HEAT LAMP) is heated using AC power. The AC power is controlled by a Triac (THY1), a semiconductor switch. 'On/Off control' is achieved when the gate of the Triac is turned on/off by a Photo triac (PC1), this is an insulting part.
In the other words the AC control part is a passive circuit. It turns the heat lamp on/off by taking a signal from the engine control section. When the 'HEATER ON' signal is activated by the engine the LED of PC1 (Photo Triac) flashes. The flashing light causes the Triac (PC1) to switch and a voltage is supplied to the gate of Triac THY1. As a result AC current flows in the heat lamp, and heat is produced. On the other hand, when the signal is off, PC1 is off, the voltage is cut off at the gate of Triac THY1, this Triac is therefore off, and thus the heat lamp is turned off.

1) Triac (THY1) feature
- 12A,600V SWITCHING

2) Phototriac Coupler (PC3)
- Turn On If Current : 15mA ~ 50mA(Design: 16mA)
- High Repetive Peak Off State Voltage : Min 600V

4.5 Engine F/W

4.5.1 Feeding

If feeding from the cassette the drive of the pickup roller is controlled by controlling the pick-up solenoid. The on/off of the solenoid is controlled by controlling the general output port or the external output port. If feeding from the manual feeder the set decides to feed the paper according to the operation of the manual sensor, and by driving the main motor, insert the paper in front of the feed sensor. When paper moves the occurrence of a paper jam is judged as below.

4.5.1.1 Jam 0 – Jam in Feed area

- After a page was picked up, paper did not enter the unit due to a paper misfeed.
- After a page was picked up, paper entered but it did not reach the feed sensor in certain time due to slip, etc.
- After a page was picked up, if the feed sensor is not on try to pick up again. After retrying if the feed sensor is still not on after certain time, it is Jam 0.
  - this indicates that the leading edge of the paper doesn't pass the feed sensor within a certain time.
- Even though the paper reaches the feed sensor, the feed sensor does not turn on.
  - this indicates that the leading edge of the paper already passed the feed sensor or that the sensor is faulty.

4.5.1.2 Jam 1 – Jam inside the print engine

- After the leading edge of the paper passes the feed sensor, the trailing edge of the paper does not pass the feed sensor within certain time. (During this time the feed sensor cannot be Off)
- After the leading edge of the paper passes the feed sensor, the paper does not reach the exit sensor within a certain time. (The exit sensor cannot be On during this time)
  - There is already paper between the feed sensor and the exit sensor.

4.5.1.3 Jam 2 – Jam in the Exit area

- After the trailing edge of the paper passes the feed sensor the trailing edge of the paper does not pass the exit sensor within certain time.

4.5.2 Drive

The main motor drives the paper feed, developing unit and the Fuser It is driven by software which controls the acceleration, constant speed and deceleration profiles. The Motor is managed with an AN44060 driver IC and controlled by step and enable signals from the CPU.

4.5.3 Transfer

The charging voltage, developing voltage and the transfer voltage are controlled by PWM (Pulse Width Modulation). Each output voltage is changeable according to the PWM duty cycle. The transfer voltage used when the paper passes the transfer roller is decided by environment recognition. The resistance value of the transfer roller changes due to the surrounding environment in the room or within the set, this change in resistance in turn changes the value of the voltage due to loading. This voltage is fed back into the set through the A/D converter. Based on this fed back value the PWM cycle is changed to maintain the required transfer voltage Page 4-10 has a different chip number Which is correct

4.5.4 Fusing

The temperature of the heat roller's surface is detected according to the resistance value of the thermistor. The thermistor resistance is measured using the A/D converter and thus the CPU can determine the temperature of the heat roller. The AC power is controlled by comparing the target temperature to the value from the thermistor. If the value from the thermistor is out of the controlling range while controlling the fusing process, the error stated in the table occurs. (For the domestic model, the Q-PID method has been applied.)

• Heat Lamp Method

Error	Description	LCD Displat
Open heat error	When warming up, it has been lower than 68°C over 28 seconds	All open heat error are blinking
Lower heat error	• Standby: It has been lower than 80°C over 10 seconds • Printing: - 2 consecutive pages: it has been lower than 145°C over 4 seconds. - 3 consecutive page; it has been 25°C lower than the fixed fusing temperature over 4 seconds.	All low heat error are blinking
Over heat error	It have been higher than 220°C over 3 seconds	All over heat error are blinking

4.5.5 LSU

The LSU consists of the LD (Laser Diode) and the polygon motor control. When the printing signal occurs, the LD is turned on and the polygon motor is enabled. When the light sensor detects the beam, Hsync occurs. When the polygon motor speed becomes a normal, LReady occurs. If these two conditions are satisfied, the status bit of the LSU controller register becomes 1 and the LSU is judged to be ready. If the two conditions are not satisfied, the error shown in the table below occurs.

Error	Description
Polygon motor error	When the polygon motor's speed doesn't reach operating speed
Hsync error	The polygon motor's speed is normal, but the Hsync signal is not created.

MEMO